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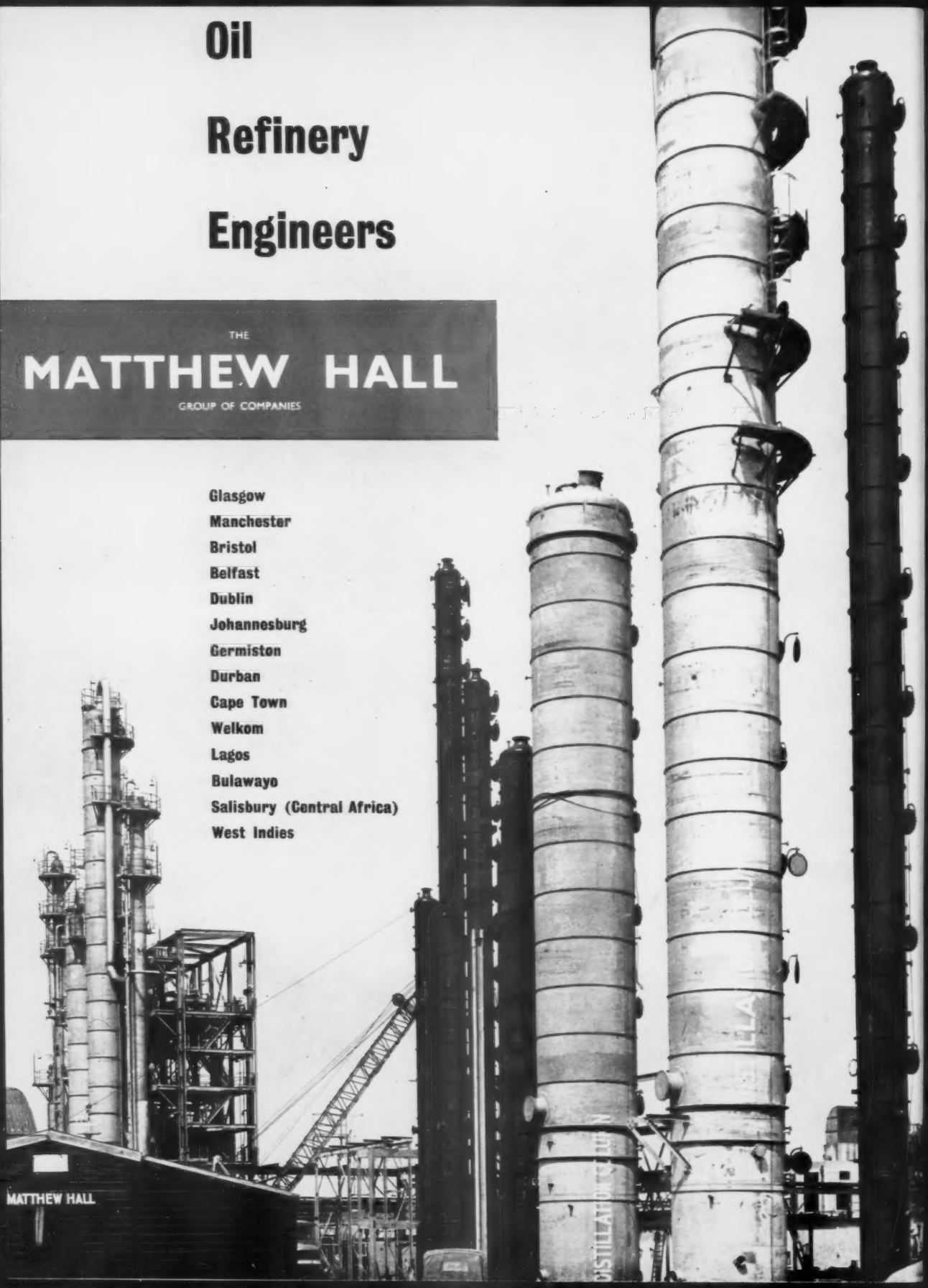

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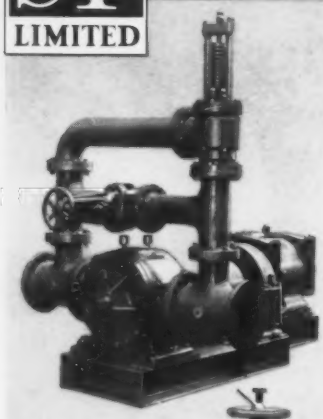
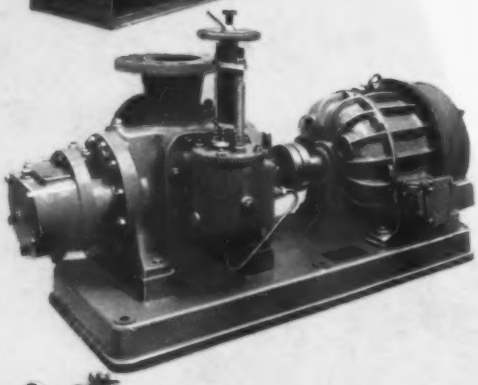


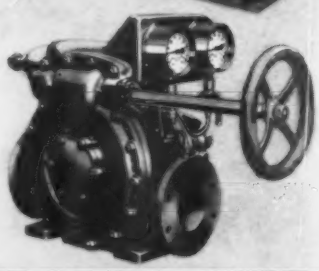
(*Left*)
Positive Acting Rotary Displacement Pump for the handling of Molasses and viscous fluids, electrically driven through totally enclosed Reduction Gear Box.

(*Below*)
Suitable for handling Spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.



(*Above*)
Positive Acting Variable Output Guinard Rotary Piston Pump. Electrically driven through Reduction Gear Box, for Oils of varying viscosity.

(*Right*)
Reversing Flow Rotary Displacement Pump for fitting on tank wagons. These pumps are driven from a power take-off on the gear box.



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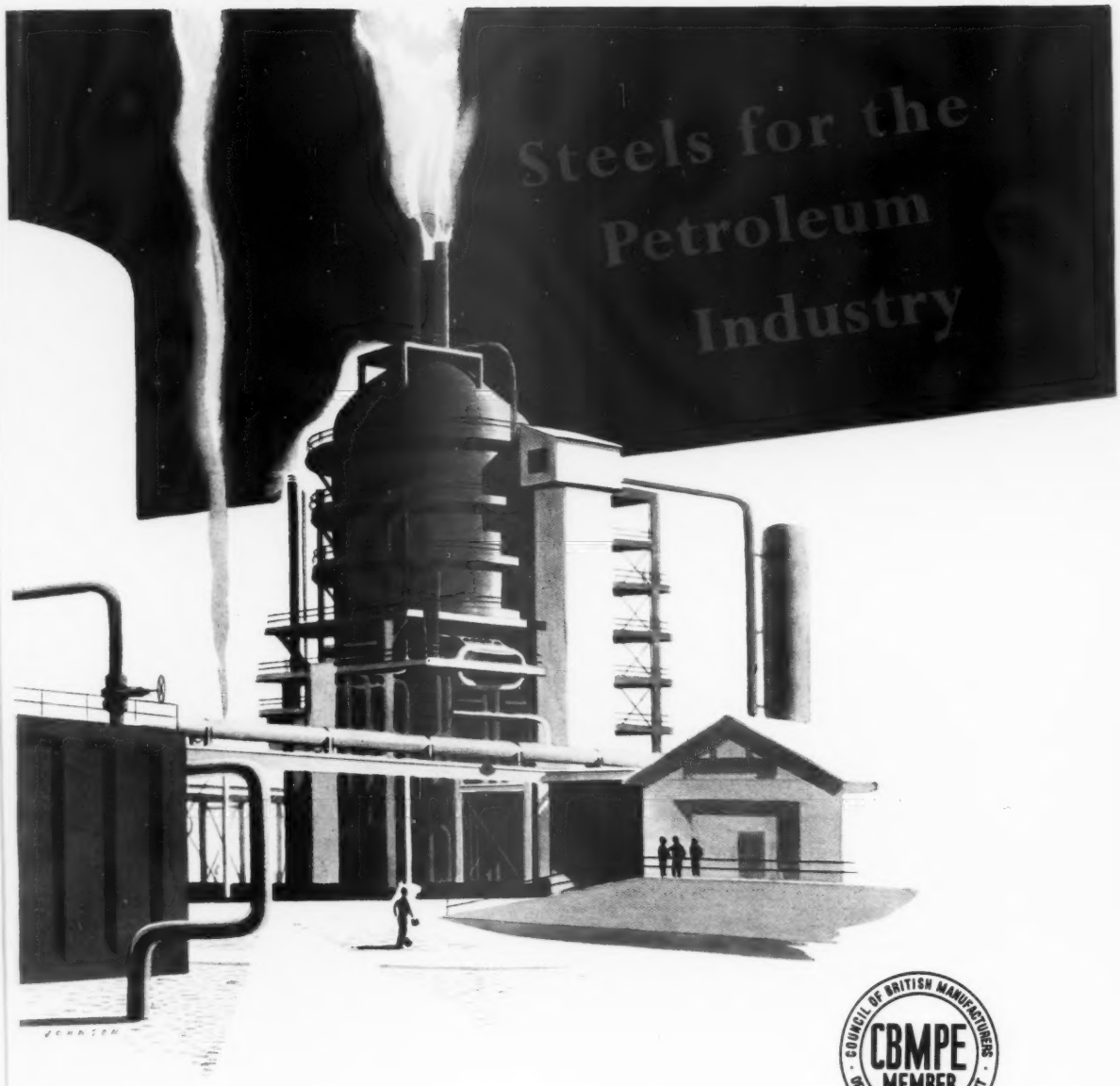

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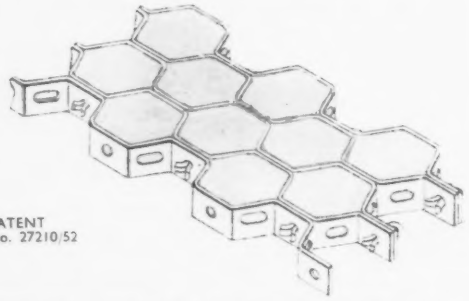

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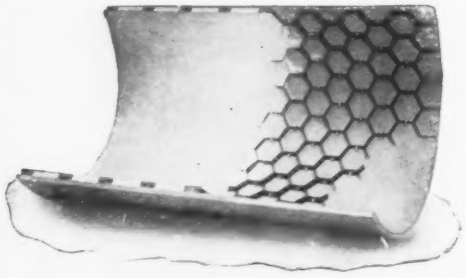

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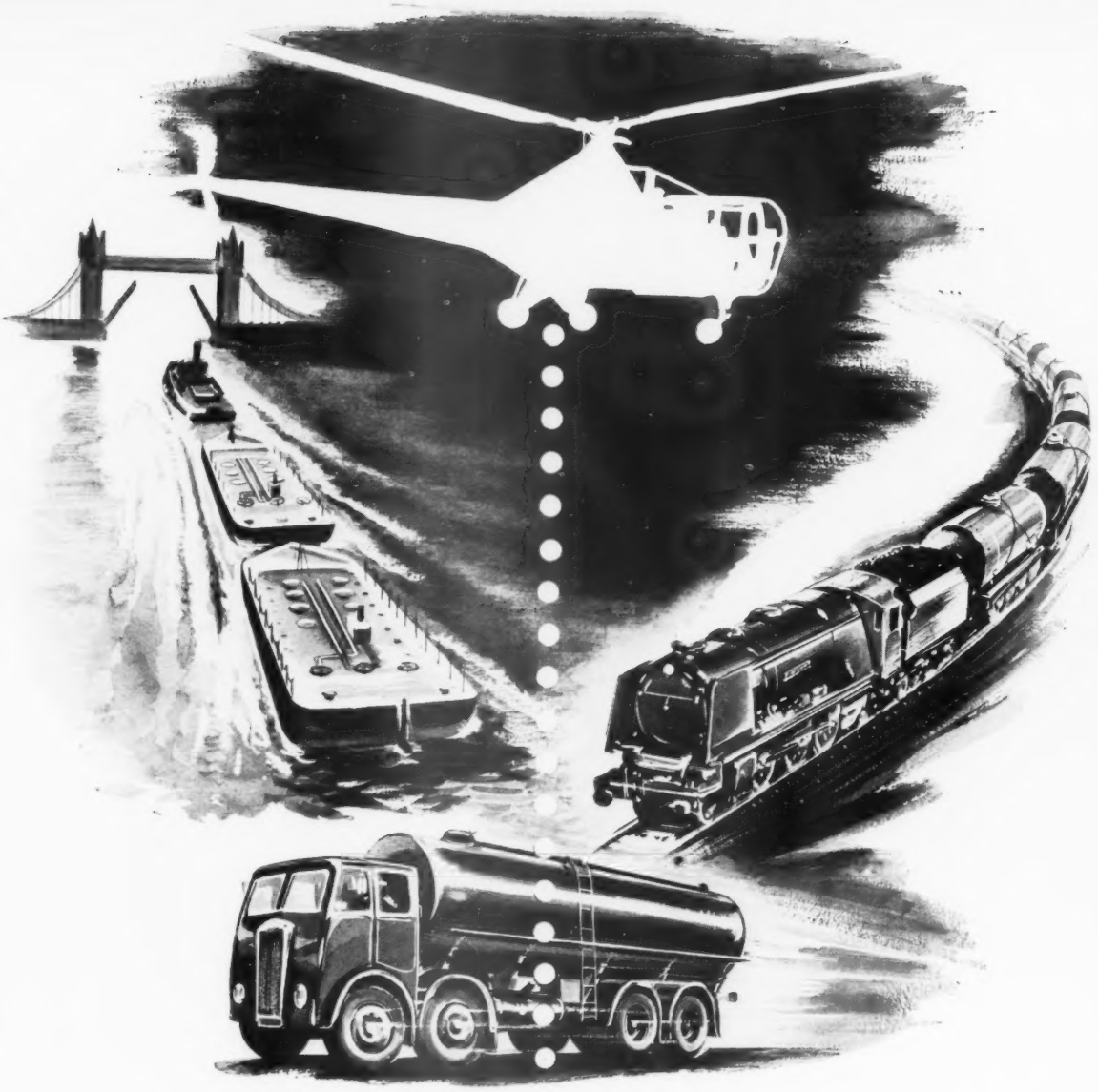

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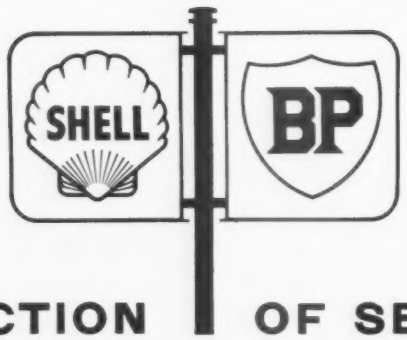
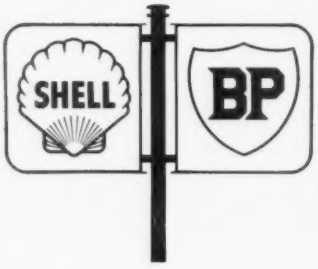


A SATISFACTION OF SERVICE-STATIONS



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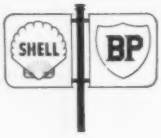

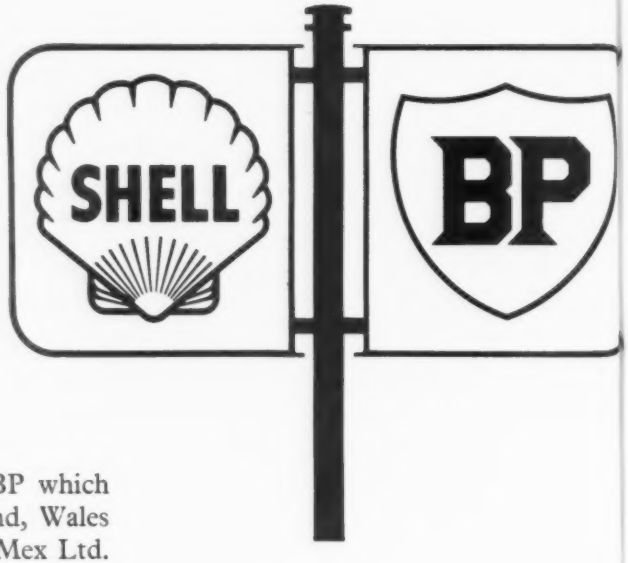

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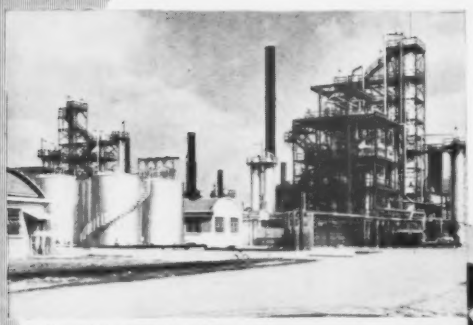
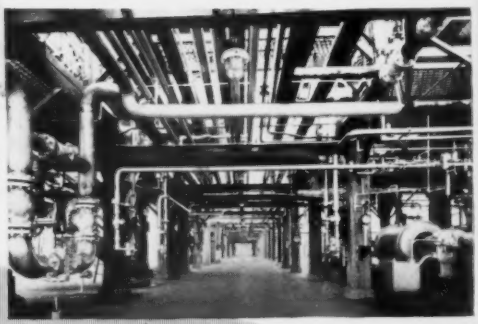


General view of crude, visbreaking, desulphurising, recovery and stabilisation units.

Graphic type panels are installed on both sides of control room with operator desk panels in centre. Crude and visbreaker unit panel is illustrated.

General view of Refinery with Mantova in background.



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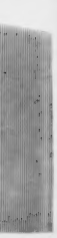

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Scientific Training— Need for U.K. Expansion

The urgent need for skilled recruits to maintain the position of the United Kingdom as a major industrial power was the main theme of the speeches delivered at Manchester on 11 November on the occasion of the Annual Dinner-Dance of the IP Northern Branch.

Among the principal guests at the Dinner was Dr B. V. Bowden, Principal of the Manchester College of Technology, who gave some striking figures to illustrate the "desperate need for expansion of institutions like the College of Technology".

"We are probably training fewer engineers and technologists in this country", said Dr Bowden, "than in any other of the major industrial powers in the world. In America there are 18 University students for every thousand of the population; in Russia there are 8, in Scotland there are 4, in Australia there are 6; in England there are only 2. Moreover, of those students who do go to the University in England, a disquieteningly small proportion read engineering. In America 15 diplomas in engineering and technology were awarded in 1954 for every hundred thousand of the population; the Swiss trained 10, we trained only 4. The total number of graduate scientists and engineers of all types which were produced in England last year was only about 17,000 as compared with 75,000 in America and about 130,000 in Russia."

Earlier in the evening, in proposing the toast of the evening "The City of Manchester", Professor Frank Morton, a vice-president of the IP, had spoken of the need to develop Manchester's facilities for training in chemical engineering and had said that the Institute of Petroleum, together with other learned societies with branches within the city, would welcome the opportunity to help in the advancement of technological education.

Professor Morton first congratulated the city of Manchester on its past record and upon the generous way it had supported the University and maintained and expanded the College of Technology. The petroleum industry was interested in all branches of technology but was particularly interested in the developments in chemical engineering, in which he was sorry to say Manchester had lagged behind the other universities. Although George E. Davis, the

The top table at the Northern Branch Dinner-Dance.

father of chemical engineering, had given his first lectures in Granby Row, before the "Tech" was built, and despite the fact that the course in chemical engineering commenced in the College of Technology in 1933 under W. Cowan was almost the first in the country, the University had not yet created a department of chemical engineering. Birmingham, Cambridge, Durham, London, and Swansea (alphabetical order!) now had flourishing schools of chemical engineering and other universities were proposing to establish schools. As a professor of chemical engineering at another university it was perhaps unwise of him to comment on this matter. Nevertheless, as a vice-president of the Institute of Petroleum it was his duty to assure Dr Bowden and those responsible for technological education in Manchester, that the petroleum industry was vitally interested in this matter and would give all the assistance it could to ensure that Manchester developed a school of chemical engineering worthy of the great traditions of the University and College of Technology, and capable of meeting the demands of the large and growing chemical and petroleum industry which the wisdom of the City Fathers had encouraged to develop in the area.

IP Northern Branch Chairman—G. M. Davies.

Development of Chemical Engineering Department

Points from Professor Morton's speech were referred to by Dr Bowden who said that the announcement that the petroleum industry was prepared to build up a new section within the Chemical Engineering Department was timely and welcome, as well as being extremely generous. He wished to express his most sincere thanks to the industry for its offer, which would not only be of material assistance but also a very great source of encouragement, since it demonstrated in an extremely practical way the confidence which the Institute must feel in the efforts of the College and in its future.

The development of the petroleum industry in the Manchester area, said Dr Bowden, had proceeded very quickly and had led to the demand for many more skilled men; it was the privilege of the College of Technology to do what it could to train them.

Great credit was due to the people who had been responsible under conditions of very great difficulty for work of high quality.

The recent announcement that the College had been given a new Royal Charter had lent point to the Government's plans for rapid expansion of the College, and it had been agreed that the one department which was most urgently in need of development was the Department of Chemical Engineering. The construction of a new department was the most important of the developments expected in the next quinquennium.

The College conceived it to be its part to provide

G. M. Davies (Chairman of IP Northern Branch) and Mrs Davies and the guests of honour—Mrs and Dr B. V. Bowden, Professor and Mrs Frank Morton, and Alderman and Mrs R. S. Harper.

Scenes at supper and in the cocktail bar at the Northern Branch Dinner-Dance.

the skilled recruits which industry needed and hoped to be able to build up a Research Department which would serve not only to train men but also to advance the science which they had to practise.

Guests at the Dinner-Dance

This discussion on a subject of great national importance was of considerable interest to the members and friends of the Northern Branch, over one hundred in number, who were present at the dinner. G. M. Davies, chairman of the Branch, presided and the principal guests were Alderman R. S. Harper, J.P. (a former Lord Mayor of Manchester), who replied to the toast of "The City of Manchester", and Mrs Harper, Professor Frank Morton and Mrs Morton, and Dr B. V. Bowden.

The President of the Institute was unfortunately unable to be present, but his good wishes were conveyed to the chairman and members of the Branch by Professor Morton.

The toast of "Our Guests" was proposed by G. M. Davies, Branch chairman, who said that the main purpose of the meeting was to enjoy an evening in the company of their ladies, whom he thanked for bringing brightness and gaiety to the gathering.

The Northern Branch was different from most other IP Branches. It was mainly concerned with lubricant manufacture and product marketing, but the need for technically qualified people was as great in the area as elsewhere.

They were pleased to have as one of their guests Professor Morton, who, apart from his scholastic training, had many years' experience in the oilfields and the refineries.

It was with the thought of the increasing demand for technicians to design and operate the refineries and other plants that they had invited Dr Bowden. Many of their members had passed through the Manchester College of Technology, which was founded in 1827 and which became the Faculty of Technology when the Royal Charter created the Victoria University in 1903.

The College had achieved great success during the last fifty years and the Government was ready to sponsor its development as a leading centre for advanced technology teaching. A number of industrial companies, including the three major oil companies, had created a trust of over one and a half million pounds to expand, modernize, and equip science buildings and to take steps to assist the teaching of pure and applied science and mathematics in independent and direct grant schools.

★ ★ ★

The new Esso Standard Oil Company oil terminal and bunkering depot pictured here came into operation recently at Newport News, Va., U.S.A.

In this picture a super-tanker is seen discharging its cargo into pipelines. On the right are storage tanks for 500,000 barrels of oil products, with the yards and coal piers of the Chesapeake and Ohio Railway beyond.

Pipelines from the oil terminal to the coal piers make it possible for ships to refuel while they are loading coal cargoes. This service will be extended later to a new ore pier which is to be constructed by the C. and O. Railway.

Personal Notes

J. Jones, formerly managing director of The National Gas and Oil Engine Co Ltd, has been appointed deputy chairman of the company and is now available in a consultative capacity to all the companies of the Group.

S. Webster, formerly deputy managing director, has been appointed managing director of the Company.

J. Addison has recently been appointed general manager of Iranian Oil Participants Ltd, shareholding company of the two operating companies set up in Iran under the 1954 Oil Agreement. Mr Addison had been secretary of the Company since its formation and is succeeded in that position by **K. L. Le Page.**

Shell-Mex and BP Ltd recently announced the appointment of **G. A. Baxter** as group manager responsible for the Northern Group of Divisions and **C. A. R. Mott** as manager of the Kerosine and Agricultural Department.

G. A. Baxter and C. A. R. Mott

A. Williams-Gardner, general sales manager of L. A. Mitchell Ltd, an IP Member-Company, has been appointed to the Board as sales director. Mr Williams-Gardner was on the research and technical development side of the then Anglo-Persian Oil Company for several years, both in this country and in Persia. On his return from Persia he joined Newton Chambers and Company as head of coal oil sales and technical development. **J. N. Mitchell,** manager of the Sparkler Filter Division, and **H. Houlker,** manager of the Industrial Dryer Division, have also been appointed to the Board.

Half-century of Service

J. Gosling, marketing assistant in the Mobil Oil Company's Northern Industrial Division, recently celebrated fifty years in the service of the Company. Mr Gosling joined the Company in 1905 in Manchester and after the first world war became sales assistant in the Manchester office. After holding the positions of senior sales assistant and subsequently office manager at the Liverpool sales office he returned to Manchester when the Liverpool sales office was transferred there.

To celebrate his fifty years' service Mr Gosling visited the Company's headquarters at Caxton House, London. He was presented with a television set by the Board and a luncheon was given in his honour.

H. Cunliffe has been appointed General Manager, Industrial Fuels, Shell-Mex and BP Ltd. This position has been newly created in recognition of the growing importance of fuel oils and is in line with the Company's policy of giving specialized attention to the industrial uses of fuel oil.

H. Cunliffe

As a part of this policy, a number of fuel efficiency officers are employed by the Company to help manufacturers and other users to make the best use of their equipment and fuel.

Mr Cunliffe has been with Shell-Mex and BP for 33 years and has held a number of managerial positions.

D. M. Morrison, M.B.E., has been elected President of the Trans Mountain Oil Pipe Line Company of Canada.

Mr Morrison was educated in both the United Kingdom and Canada and has been with Shell for 28 years. He has held managerial positions of increasing importance and at the time of his new appointment was Vice-President in charge of manufacturing with the Shell Oil Company of Canada Ltd.

N. P. W. Moore, B.Sc., D.I.C., A.F.Inst.Pet., has recently been appointed Reader in Mechanical Engineering in the University of London, tenable at the Imperial College of Science and Technology.

Brothers' 92 Years Service

Two brothers, F. and H. Wells, have just completed a combined service of 92 years with the Mobil Oil Company. Both brothers have spent most of their time in the automotive branches of the Company, F. Wells, the senior, having joined the Company in 1908 and H. Wells in 1910.

This remarkable service record was celebrated by a visit to Head Office to meet the chairman and other directors of the Company and by a dinner-theatre party.

F. B. Barribal, Mobil Oil Company's general sales manager (Automotive), photographed with Frank and Harry Wells and their wives at a celebration of the brothers' 92 years service with the Company.

The Gasification of Heavy Fuel Oil*

By **F. H. GARNER, O.B.E.** † (*Fellow*) **and R. LONG** †

PART I—"BLOW" AND "RUN" PROCESSES

In the early days of gas lighting considerable interest was evinced in the manufacture of gas from oil (chiefly whale oil). In *Nicholson's Journal* of 1805 a Dr Henry had described the production of gas by the destructive distillation of oil and in 1815 John Taylor obtained a patent for an apparatus designed to carry out the operation. In 1819 an oil-gas plant was erected at the Apothecaries' Hall and not long afterwards an oil-gas company at Bow obtained an Act of Parliament for the purpose of lighting the Whitechapel Road and vicinity.

Companies had been formed for the use of oil-gas in Norwich, Hull, Plymouth, Taunton, Liverpool and Dublin. The particular advantages appeared to be a relative compactness of the plants and the freedom of the gas from sulphur and other corrosive compounds. A plant was put into operation at Old Ford which operated satisfactorily for at least a year and a number of smaller plants were constructed. Attempts were then made to establish the use of oil-gas in the cities of London and Westminster, duplicating the existing plants and mains for the supply of coal-gas. A long investigation by a select committee of the House of Commons followed, at which a number of the leading scientists of the day, including Faraday and John Dalton, gave evidence. The project was, however, finally rejected because the cost and advantages of operation were not sufficient to justify duplication of the existing facilities of the Chartered Gas Light Company and other coal-gas companies.

For a century and a half the gas industry has employed systems of coal carbonization whereby much of the potential heat of the coal is converted into a more readily usable form and for many years this has been supplemented, particularly for peak loads, by carburetted water gas using gas oil.

However, in recent years it has become common knowledge that the supply of good gas-making coals is decreasing; at the same time the price of coal is increasing. The gas industry, therefore, is making every endeavour to devise processes for the production of gas from sources other than the usual gas-making coals. Much work is being carried out upon the complete gasification of weakly caking coals. Considerable interest is also being shown in the possibility of making base-load as well as peak-load gas from oil.

An important factor in producing peak-load gas is that capital and fixed charges on the plant should be low. Operating costs and the cost of raw materials are particularly important in the case of a process designed to produce base-load gas and there is, therefore, a considerable incentive to use a heavy fuel oil as the raw material rather than gas oil employed normally in carburetting water gas, which is in increasing demand as diesel fuel and for other purposes. The shortage of middle distillates has led to great interest being shown in processes which can make use of the cheaper heavy residual fuel oils.

The early development of processes for the manufacture of oil-gas took place mainly on the Pacific Coast of the U.S.A. (prior to the introduction of natural gas to that area) where coal and coke were relatively expensive and petroleum was available. Most of the American processes, however, produce gases which would be unsuitable for direct distribution in Great Britain for it is important that any alternative to the normal town gas should possess similar combustion characteristics so that it may be substituted in any proportions for the latter. Many of the processes produce a gas of low hydrogen content and rich in unsaturated hydrocarbons so that the specific gravity is high in comparison with that of town gas. Such gas can, of course, be used in admixture with other gases of low specific gravity if these are available. Some processes produce carbonaceous deposits and consequently have a low thermal efficiency while at the same time some difficulty is involved in the removal of carbon from the gas.

The manufacture of carburetted water gas is, of course, a widely used supplementary gas-making process in the U.K. and is particularly useful for meeting peak loads because of the rapidity with which the plant may be started up. Blue water gas is first produced by passing steam through a deep fuel bed of hot coke. This gas, with a calorific value of about 300 B.t.u./cu.ft., is enriched by passing through the carburetter and superheater of the plant in which oil is injected, vaporized, and cracked in turn. The process is necessarily an intermittent one, for the endothermic steam-carbon reactions cause a rapid fall in the temperature of the fuel bed and an air blow through the fuel bed must alternate with the steam run. The nature of the oil plays an important part and usually gas oil, a distillate fuel oil, is employed. The carburetter and superheater are filled with a chequer work of refractory bricks heated to about 750°C during the blow period. R. H. Griffith[1] has pointed out that the yield of gas from the oil depends upon the temperature of cracking, the rate of oil injection, and the composition of the oil used. Griffith has also shown that a knowledge of the proportion of open-chain paraffin and unsaturated hydrocarbons gives a useful indication of the thermal yield of permanent gas, as these hydrocarbons are more valuable than the aromatics for purposes of cracking to permanent gas. If the original oil comprises mainly chain compounds—paraffins and olefins—there is less tar and carbonaceous deposit and more gas, of better quality, than when the oil is composed mainly of ring compounds. The gasification of the oil occurs in an atmosphere of blue water gas which contains some 50 per cent by volume of hydrogen and the absorption of some hydrogen to give gaseous paraffin hydrocarbons, principally methane, has an influence on the gasification.

Much effort has been devoted in the U.S.A. to methods of using heavy oils for gasification. Heavy oils have certain disadvantages, however, as, owing to their high viscosity, heated pipelines and storage tanks are required, and in the manufacture of carburetted water gas, ordinary carburetters cannot be used, because the residue of carbon would, on accumulation, soon render the set inoperable. There is also a tendency for the tar to form an emulsion and it is, therefore, more difficult to handle.

One of the most popular methods[2] of avoiding serious difficulty is by the use of an empty carburetter into which the heavy oil is sprayed in a finely divided state using a high-pressure mechanical spray nozzle. The carbonaceous residue is deposited on the sides and floor of the carburetter, from

* Paper read to the Institute of Petroleum, Stanlow Branch, 19 October 1955.

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TABLE I

TYPICAL ANALYSES OF GASES OBTAINED IN VARIOUS PROCESSES

Process	*Typical Town gas*[12]	*C.W.G. 400*[23]	*C.W.G. 500*[23]	*Pacific Coast*[4]		*Jones*[7] *(At Honolulu)*	*Jones*[8] *(At Gloucester)*	*Hall Process*[9]	*Twin Generator*[3,9]	*Dayton*[4]		*GEI M*[23]	*GLC C*[22]	*Segas*[15] *(At Sydenham)*		*ONIA-GEGI*[3] *(At Stafford)*	
Fuel used	*Coal*	*Coke – gas oil*	*Coke – gas oil*	*Refinery oil residuum*		*Fuel oil (11% Conradson carbon)*	*Fuel oil*	*Fuel oil (6% Conradson carbon)*	*Fuel oil (3·2% Conradson carbon)*	*Light fuel oil*		*Gas oil*	*Gas oil*	*Heavy fuel oil (950 sec.)*		*Heavy fuel oil (950 sec.)*	
				Single shell	*Two shell*					450	500						
Gas composition % by vol																	
CO_2	3·5	4·8	4·1	2·1	4·8	3·2	4·6	4·7	5·8	5·9	6·1	3·0	2·7	12·1	11·0	9·0	10·4
O_2	0·4			0·6	0·6	0·6	0·2	0·4	0·4	0·5	0·5	0·9	0·4	0·6	0·4	0·4	0·4
C_nH_m	2·4	3·9	7·6	3·0	3·7	3·3	0·5	23·4	21·0	14·5	15·9	14·0	15·3	5·2	6·7	3·4	3·4
CO	14·0	37·6	35·3	8·4	10·6	15·5	7·4	1·6	1·5	7·2	5·5	11·0	10·0	16·7	14·7	17·6	19·4
H_2	51·0	43·4	40·6	52·8	49·4	49·8	62·5	19·4	19·0	2·5	1·5	2·2	2·7	48·2	48·9	44·6	38·8
CH_4 ($-C_2H_4$)	22·3	4·5	7·8	30·6	25·4	22·8	12·9	34·7	31·6	7·6	8·7	7·4	9·8	13·5	15·3	16·2	23·0
N_2	6·4	5·8	4·6	2·6	5·5	4·8	11·9	15·3	20·7	61·8	61·8	61·5	59·1	3·7	3·0	8·8	4·6
Sp. gr. (air = 1)	0·45	0·60	0·65	0·38	0·46	0·46	0·38	0·83	0·81	1·0	1·0	1·0	1·0	0·58	0·55		0·62
Cal. val. B.t.u. cu.ft	500	400	500	566	548	520	364	1047	900	450	500	465	500	473	502	480	496

It will be seen that there is a wide range of calorific values and of CO H_2 CH_4 ratios.

which it must be removed, partly by burning off during the blow period and partly by periodic removal by mechanical means; often cleaning must be carried out daily. In another process most of the oil is sprayed on to the top of the coke fuel bed in the generator and only about one-fifth goes into the carburetter, which contains a heating surface of large refractory tiles set far apart. G. le B. Diamond[3] has described recent work on this problem by the West Midlands Gas Board in conjunction with Humphreys and Glasgow. A standard carburetted water gas plant was modified so that an additional supply of air could be provided above the fuel bed, entering tangentially and at a downward angle. Chequer-work in the carburetter for a distance halfway down this vessel was removed and arches were built to support the upper part of the chequer-work. The chequer-work in the carburetter was in this way divided into two sections with a space between. The working cycle was modified so that, at the end of the normal blow period, the blast to the generator was shut off and secondary air was supplied at the maximum rate for burning the carbon deposited on the lower chequers of the carburetter during the previous gas-making period. This air was preheated in the upper bank of chequers in the carburetter to accelerate burning of the carbon. About half the oil was injected into the generator and half into the carburetter. In this way it was found that a heavy oil with a Conradson carbon of 10-11 per cent could be gasified, but with a reduction in plant capacity of 10 per cent as compared with normal working with gas oil.

The various processes of oil gasification, other than the carburetting of blue water gas produced from coke, fall into three main groups which may be summarized as follows:

(*a*) Alternate "blow" and "run" processes.
1. Pacific Coast oil-gas process.
2. Jones (New) oil-gas process.
3. Hall Process, four shell plant, two shell plant.
4. Twin-generator process.
5. Refractory screen process.
6. Semet—Solvay process.

(*b*) Partial combustion in air or air and steam.
1. Dayton process.
2. GEIM process.
3. GLCC process.

(*c*) Catalytic gasification processes (which, however, still require a "blow" and "run" cycle.)
1. Segas process.
2. ONIA—GEGI process.

Of the last group the first was developed in the United Kingdom and the second in France.

Attention will be paid mainly to those of the above processes which have been or are to be operated in Great Britain.

Typical analyses of gases obtained by the various processes are given in Table I.

"Blow" and "Run" Processes

Pacific Coast Processes

It seems appropriate to begin by considering briefly the Pacific Coast process[4,5] as this is the oldest and was for many years the most important oil gas process in the U.S.A. for producing town gas.

The process is an intermittent one with a heating period in which fuel oil is burned with air and a gas-making period during which oil is gasified with steam. The gas produced is a mixture of blue water gas, formed by reaction of the steam and carbon, and oil gas. The gas contains, therefore, both saturated and unsaturated hydrocarbons, resulting from the cracking of oil, together with hydrogen. Usually the plant is operated to produce a gas of from 550 to 570 B.t.u./cu.ft and both single-shell and two-shell plants have been operated. Large amounts of carbon are formed, some of which deposits on the heating surfaces and the remainder remains suspended in the gas as carbon black. A viscous tar is formed with a high proportion of so-called "free carbon" and of naphthalene.

Jones (New) oil gas process

In 1928 an improved type of oil-gas process was developed by L. B. Jones and one or two plants have been operated (on a relatively small scale), in Great Britain for a number of years.

Perhaps the major problem in oil gasification is the formation of carbon, which becomes more acute with oils of high Conradson carbon. Attempts to avoid this trouble led to the adoption of the so-called regenerative processes in which the blast air is preheated in the regenerative part of the operation and serves to burn off deposits on the chequer-work through which it is passed. The Jones process uses this technique and at the same time carbon is recovered from

the gas and is a useful product, in fact the plants operated in the U.K. have been modified to recover as much carbon as possible.

An advantage of this process is that the gas is of low specific gravity and thus may readily be mixed with carburetted water-gas or with gas from, say, the Hall process. C. L. Taylor[6] has given operating results for a plant at Gloucester and results for an earlier plant have been given by G. M. Gill and L. B. Jones.[7]

TABLE II
OPERATING RESULTS—JONES (NEW) OIL GAS PROCESS

Gas	*Honolulu plant (Gill and Jones[7])*	*Gloucester plant (Taylor[6])*
Calorific value	520 B.t.u/cu.ft	364 B.t.u/cu.ft
CO_2	3·2	4·6
O_2	0·6	0·2
C_nH_m	3·3	0·5
CO	15·5	7·4
H_2	49·8	62·5
CH_4 (+ C_2H_6)	22·8	12·9
N_2	4·8	11·9
Sp. gr. (air = 1)	0·46	0·38
Therms gas/ton oil (sp. gr. of oil = 0·962)	268·0	156·7
Therms gas/gal oil.	1·15	0·67 (assuming sp. gr. of oil = 0·96)
Thermal efficiency of gas production (therms in gas/therms in total oil)	64%	38% approx. (assuming cal. val. of oil = 18,500 B.t.u/lb)

In Table II the wide difference between the therms/gal oil calculated from the data reported for the two plants will be noted.

The cycle of operations in one type of Jones plant is as follows:—

(i) Primary air (with or without the admixture of steam) is admitted beneath the grate of one filter producer, heating it and giving producer gas which passes to the make chamber of the generator on the same side. There it meets secondary air preheated in the top section of chequer-work.
The products of combustion then heat up the rest of the plant.

(ii) Steam is introduced through the carbon fuel bed, thereby making blue water gas which constitutes the atmosphere in which oil gasification occurs.

(iii) A spray of oil is introduced into the gas-making chamber and the oil is cracked in the atmosphere of superheated steam and blue water gas.

(iv) The resulting gas has its carbon removed by filtering through the filter producer on the opposite side of the plant to the generator being employed. The process is then operated in the reverse direction after a suitable steam purge.

Hall High B.t.u. Oil Gas Process

In 1947, the American Gas Association initiated a research programme the object of which was to develop a process for the production of a high calorific value gas from fuel oils of high Conradson carbon.

E. L. Hall devised a process[8] in which the regenerative principle was applied to both the air and the steam, and tests indicated that it was capable of producing gas of 1000 B.t.u/cu. ft. from fuel oils with a Conradson carbon figure of up to 13 per cent.

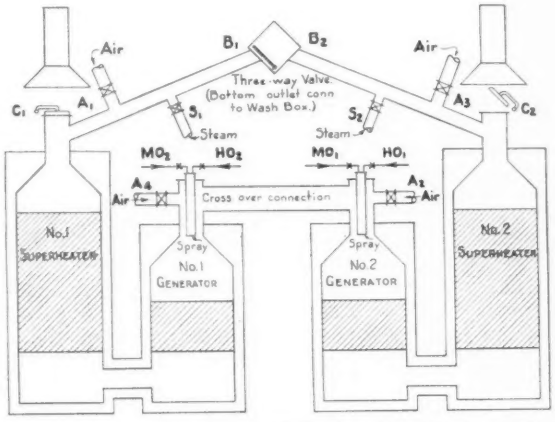
The original plant comprised the carburetters and superheaters of two adjacent water gas sets and is illustrated in Figure 1. The tops of the two carburetters (now called generators in this process) were joined by a cross-over connexion. The tops of the superheaters were connected to a three-way valve which had a bottom outlet to a single wash-box but later this was changed so that both wash-boxes could be utilized in parallel from the same three-way valve outlet. Combination "make-oil" sprays and "heating-oil" burners were placed in the top of each generator. Connexions for air were made at the tops of all four shells and steam connexions at the tops of both superheaters.

The complete regenerative cycle occupied a period of eight minutes; four minutes for the complete blow and run in each direction. The cycle consisted of about 50 per cent blow time and 50 per cent gas-making time.

The sequence of operations was briefly as follows:—

(i) *Blast period to heat No. 2 generator and No. 2 superheater*

Primary air admitted to superheater No. 1 scurfed the carbon deposit from the chequer brickwork in this vessel and No. 1 generator. Secondary air admitted to generator No. 2 together with heating oil raised the temperature of this vessel and superheater No. 2.



By courtesy of The American Gas Association

Fig. 1. *Original Hall Process*

(ii) *Make period in No. 2 generator and No. 2 superheater*

Steam was admitted to No. 1 superheater and was preheated, oil was admitted to No. 2 generator and the make gas left the top of No. 2 superheater and passed to the wash-boxes via the three-way valve. During this period carbon was deposited in No. 2 generator and No. 2 superheater. The blast was then admitted to No. 2 superheater and the above cycle repeated in the opposite direction, after suitable purging of the plant.

The cracking temperatures depended upon the oil used but the average temperature at the bottom of the superheater was about 870° C. The top superheater temperature averaged about 650° C and due to the regenerative cycle considerable economy in heat was secured. Some of the operating results are summarized in Table III and show the decline in calorific value of the gas with increasing Conradson carbon of the fuel oil but there is no apparent connexion between Conradson

carbon and the thermal efficiency of gas production. It will be noted that the calorific value of the gas is more nearly akin to natural gas than to coal-gas supplied in Great Britain and this applies also to the Twin-generator process.

A more recent development is the two-shell version of the Hall process, illustrated in Figure 2, which is cheaper and occupies less ground space than the original four-shell arrangement. Such a plant has been ordered from the Woodall Duckham Construction Co Ltd (who are licensees of the Gas Machinery Co of Cleveland, U.S.A.) by the South Western Gas Board. This plant is to be installed at the Gloucester works and will provide approximately 1 million cu.ft. per day of rich gas which will be blended with a lean gas such as Jones gas (which as already indicated, is of low specific gravity).

Twin-Generator Process

This process[9,5] which has been operated on oil with up to 6 per cent Conradson carbon produces a gas of high calorific

TABLE III

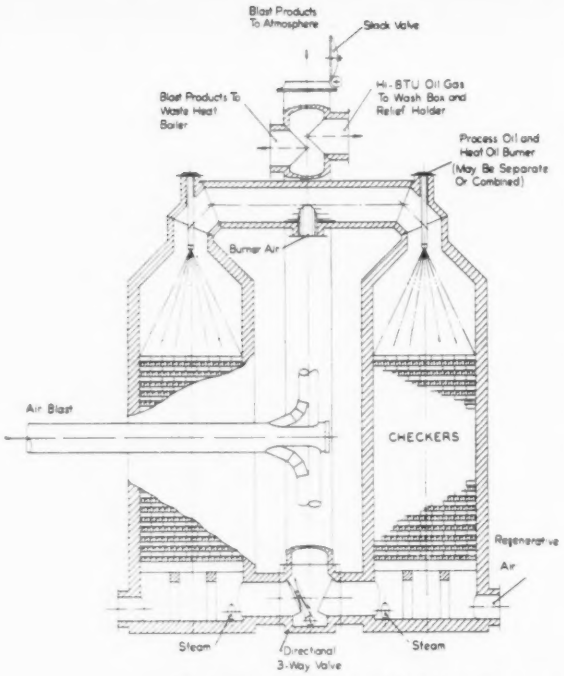
OPERATING RESULTS—HALL* HIGH B.T.U. OIL GAS PROCESS[5]

Oil used					
Conradson carbon %	0·2	3·16	6·02	13·03	12·56
Ash %	0·02	0·01	0·04	0·16	0·16
Sulphur %	1·1	0·97	1·69	2·38	2·96
Heating value, therms/U.S. gal	1·43	1·45	1·44	1·48	1·49
Enriching value (Dick Method, av. 1400° to 1600° F), therms/U.S. gallon	1·04	0·99	1·03	0·94	0·95
Gas					
Cal. val. B.t.u./cu.ft.	1046	1006	1047	966	974
Sp. gr. (air = 1)	0·85	0·87	0·83	0·87	0·83
Analysis: CO_2	4·9	5·5	4·7	6·9	6·0
C_nH_m	26·2	22·4	23·4	23·6	24·3
O_2	0·5	0·5	0·9	0·4	0·6
CO	1·6	2·0	1·6	1·7	1·7
CH_4	24·7	16·8	28·1	22·7	21·8
C_2H_6	10·5	15·8	6·6	8·9	6·8
H_2	16·1	20·0	19·4	17·1	21·3
N_2	15·5	17·0	15·3	18·8	17·6
H_2S grains/100 cu.ft.	213	328	318	305	334
Organic sulphur grains/100 cu.ft.	23	22	22	34	52
Heating oil (I. G. per 1000 cu.ft.*)	0·84	0·68	0·78	0·23	0·57
Make oil (I. G. per 1000 cu.ft.*)	9·57	9·54	8·89	9·74	11·09
Total oil (I. G. per 1000 cu.ft.*)	10·41	10·22	9·67	9·97	11·66
Therms gas/I. G. total oil	0·96	0·98	1·03	1·00	0·86
Thermal efficiency of gas production (Therms in gas/therms in total oil)	55%	55%	60%	56·5%	49%

* (1000 B.t.u. basis for the gas)

value (about 900-1000 B.t.u/cu.ft.) and of high specific gravity. The figures in Table IV indicate that the thermal efficiency of gas production is about 50-53 per cent.

Some difficulty was experienced in using oil with a Conradson carbon figure of 6 per cent and the process usually employs a lighter fuel.



By courtesy of The Gas Machinery Company

Fig. 2. Two-shell Inverted "U" version of the Hall Process.

Refractory Screen Process

This process was developed in New York in 1932 and involves the use of a three-shell plant. The generator of the plant contains a refractory screen into which steam is admitted with fuel oil. The oil sprayed into the top of the generator is vaporized and the hydrocarbons cracked to a permanent gas

TABLE IV

OPERATING RESULTS—TWIN-GENERATOR PROCESS

Oil used			
Conradson carbon %	0·2	3·16	6·02
Gas			
Cal. val. B.t.u./cu.ft.	1088	900	970
Sp. gr. (air = 1)	0·81	0·81	0·88
Analysis, CO_2	4·1	5·8	6·4
C_nH_m	27·1	21·0	25·9
O_2	0·4	0·4	0·5
CO	0·7	1·5	0·8
Paraffins	39·7	31·6	33·3
H_2	17·2	19·0	13·4
N_2	10·8	20·7	19·7
Heating oil (U.S. gal per 1000 cu.ft.*)	1·69	0·99	0·89
Make oil (U.S. gal per 1000 cu.ft.*)	11·42	12·70	12·39
Total oil (U.S. gal per 1000 cu.ft.*)	13·11	13·69	13·28
Total oil (I.G. per 1000 cu.ft.*)	10·9	11·4	11·06
Therms gas/I. G. total oil	0·92	0·88	0·90
Thermal efficiency of gas production (Therms in gas/therms in total oil).	53%	50%	52%

* (1000 B.t.u. basis for the gas)

on passing through the refractory screen. The gases pass to a carburetter and superheater. The mixture of "blue gas" and cracked oil gas may then be enriched.

Steam is then passed up through the generator to make "blue gas" with some of the hot carbon in the refractory screen.

The up-steam is then shut off and the blast portion of the cycle begins.

Gas produced by this process may vary from 500 to 1100 B.t.u/cu.ft. in calorific value.

Partial Combustion Processes

It is not proposed to discuss this group of processes since they involve the gasification of *light* oil in either air or a mixture of air and steam by a continuous process. The combustion of a portion of the oil provides the heat necessary for the cracking of the remainder into permanent gases. The nitrogen of the air used is a diluent in the resulting gas and the specific gravity is high, so that it is unsuitable for distribution except in admixture in *restricted proportions* with normal gas.

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U.K. Petroleum Consumption

An increase of nearly two million tons occurred in U.K. oil consumption (excluding bunkers) during the period January to September 1955 compared with the same period in 1954.

Figures published by the Petroleum Information Bureau on behalf of the U.K. Petroleum Industry Advisory Committee show increases in the consumption of every type of petroleum product, with a particularly marked increase in the case of gas, diesel and fuel oils.

There was a continued rise in sales of premier grades, while sales of standard grades again showed a slight decline.

U.K. Deliveries into Inland Consumption of Petroleum Products
January to September (tons)

Product	1954	1955
Motor spirit (incl. motor benzole)	4,456,057	4,744,398
Industrial spirits (incl. industrial benzole)	89,590	98,853
White spirit	111,408	112,271
Kerosine		
Burning oil	427,904	474,142
Vaporizing oil	567,599	557,399
Total kerosine	995,503	1,031,541
Derv fuel	1,042,671	1,181,971
Gas, diesel, and fuel oils		
Gas-diesel oil	1,407,714	1,580,138
Fuel oil	3,140,457	3,812,140
Total gas, diesel, and fuel oils (excl. refinery consumption)	4,548,171	5,392,278
Refinery consumption	1,413,284	1,535,468
Total gas, diesel, and fuel oils (incl. refinery consumption)	5,961,455	6,927,746
Lubricating oils and greases	631,306	660,158
Paraffin wax and scale	34,246	34,549
Propane and butane	43,554	46,838
Bitumen	617,365	654,334
Other products	1,543,189	1,742,359
Total all products	15,526,344	17,235,018

Note: Deliveries for bunkers for ships engaged in the foreign trade are not included. Figures refer to *inland consumption* only

U.K. Motor Spirit Deliveries to Dealers and Commercial Consumers
January to September (tons)

Category and Grade	1954	1955
Dealers		
Premier grades	1,916,626	2,173,792
Standard grades	1,091,662	1,087,664
Total	3,008,288	3,261,456
Commercial consumers		
Premier grades	215,751	242,540
Standard grades	1,232,018	1,240,402
Total	1,447,769	1,482,942
Total		
Premier grades	2,132,377	2,416,332
Standard grades	2,323,680	2,328,066
Total	4,456,057	4,744,398

Around the Branches

BAHRAIN, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH-WALES, STANLOW, TRINIDAD

Fawley Branch

Mr Spaink, in place of Mr Stockings who was indisposed, visited Fawley on 21 October 1955, to give a lecture entitled "Diesel Traction for Railways".

The subject was too large to cover extensively in the time available and Mr Spaink restricted himself to a discussion of the electrical traction aspects. Special emphasis was laid on the mechanism for controlling the individual electric motors driving the axle shafts and thus controlling the diesel prime generator.

Beginning with an explanation of electro-magnetic induction and the principles of simple electric motors and dynamos, Mr Spaink demonstrated how the complex control circuits for modern main-line locomotives can be explained in similar terms. This logical and very interesting approach was excellently illustrated with a large number of slides.

The meeting, which was well attended, was closed with a vote of thanks to the lecturer.

London Branch

L. H. Tarrant presented a paper on 18 October entitled "Searching for Oil in Britain". He introduced the subject by saying he felt the term "oil" should include natural gas since it was in the search for gas that the main effort was now being concentrated by the Gas Council in co-operation with D'Arcy Exploration Company Ltd. The importance of natural gas was due to the ever-increasing demands for gas, particularly for heating purposes in industry.

Over the past 37 years nine small oilfields had been discovered in Britain and since 1953 a systematic drilling programme had been in progress. Whilst production in the United Kingdom had represented a very small proportion of the total world production it was of very great importance during the war years, about 50 million gallons of petroleum products being produced in the years 1942-5. This production included about six million gallons of high-grade lubricants.

The speaker then discussed the occurrence of oil generally, the type of rock formation in which it was most likely to be found, and the various modern methods of geological and geophysical exploration.

Dealing with the United Kingdom, Mr Tarrant showed slides indicating the areas of particular interest and gave a short history of the industry from the early seepages to the modern producing well.

The nationalization of resources had resulted, he said, in an intensification of effort in the search for oil, but although gas together with coal and mineral deposits had been found, little oil in quantity had as yet been discovered.

The paper was followed by a Gas Council film dealing with the search for natural gas in Britain.

After a number of questions from the floor, H. G. Spence moved a vote of thanks which was enthusiastically acclaimed.

Northern Branch

At their meeting on 18 October Dr R. Schnurmann delivered an interesting address to the Northern Branch on "Magnetic Particle and Penetrant Methods for Non-destructive Testing of Materials". During the course of his address Dr Schnurmann gave practical demonstrations of the methods concerned and for this purpose had with him a considerable amount of apparatus. His two assistants, Mr Bezer and Mr Kay, were fully occupied during the lecture, and the chairman proposed a vote of thanks to Dr Schnurmann and to them for a very interesting evening.

South-Eastern Branch

A meeting was held on 1 November 1955, at the King's Head Hotel, Rochester, when P. T. Cox, exploration manager of the British Petroleum Co Ltd, gave a talk entitled "Exploration for Oil" to a gathering of 40 members and friends.

After dispelling any ideas about the usefulness of hazel twigs, and quoting figures to show the large financial outlay represented by the modern well, particularly in isolated parts of the world where climatic and topographical barriers have often to be surmounted at great cost, Mr Cox traced the history of the prediction of oil from the surface. The final test of all is, of course, to drill and see. Early methods of drilling on or near seepages were soon supplanted by geological surveys, seeking evidence of the favourable structures, anticlinal, faulted, or stratigraphical traps. The modern precise physical methods using gravity, magnetic, and seismic techniques were outlined, and the type of structures and rocks associated with oil-rich areas described.

A brief outline of the world's proven reserves and the geographical disposition of those reserves concluded a very interesting and instructive talk. Considerable discussion followed and after a break for refreshments a film, *Station* 307, was shown. The film depicts prospecting by the famous French exponent of underwater operations, Jean Cousteau, in the Persian Gulf, and the underwater shots were of particular novelty.

South Wales Branch

The second lecture meeting of the 1955-6 session was held at the Training Centre, National Oil Refineries Limited, Llandarcy, on 3 November, with P. F. Ellis as Chairman.

The speaker was K. Anthony, A.S.A.A., A.C.W.A., deputy chief accountant, National Oil Refineries, who took as his subject "The Why and Where of Costs".

Mr Anthony outlined the general task of the accountant in the particular job of providing the operational story in terms of management efficiency. Within a very short space of time, said Mr Anthony, man's technical evolution had vastly speeded up and this rate of change had been reflected in the oil industry with the ever-increasing demands for power.

In general, demand had exceeded supply (with occasional out-of-balances) making it relatively easy for any firm to cover its costs, but conditions now were causing costs of operations to assume an increasingly major part in the total economy.

Mr Anthony declared accountancy to be a service to management. The purpose of a cost statement was to reduce to cost figures the various expenditures in effort and materials—and in the end reflect the level of human effort and productivity.

It was necessary in order to measure effectiveness, that standards should be set through which a correct perspective could be obtained. Forward planning, with the necessary standards or targets of achievement and the regular highlighting of variances, enabled management to take the appropriate action.

Using charts, the lecturer illustrated the relative importance of fixed and variable costs and explained the meaning of "break even point", ending his talk, to the surprise of those chemists present, by elaborating on his view that the function of accountancy is to act as a catalyst.

J. Appleton proposed a vote of thanks which was readily accorded.

Stanlow Branch

The 112th meeting of the Branch was held at the Grosvenor Hotel, Morecambe, on 5 October, 1955.

A paper entitled "Developments of Oil Cracking as a Source of Raw Materials for the Polymer and Plastics Industry" was read by J. W. Woolcock of Imperial Chemical Industries Ltd. The speaker briefly traced the history of oil development in Europe up to the Gyro, Dubbs and Cross cracking processes. He pointed out the divergence between plant for the production of ethylene and plant specifically designed for gasoline production, and went on to explain the process used by I.C.I. for chemical synthesis.

A short résumé was then given of the products manufactured, namely Polythene, styrene monomer, Terylene, etc.

Following a short discussion and a vote of thanks by Mr Willcocks the meeting closed.

The Gasification of Fuel Oil

At a meeting of the Branch held at the Grosvenor Hotel, Chester, on 19 October a paper entitled "The Gasification of Fuel Oil" was presented by Dr R. Long of Birmingham University.

The lecturer reviewed the various methods of using heavy fuel oil for gas making and dealt in detail with some of the processes used.

These processes involved either direct gasification or gasification by catalytic methods, said Dr Long. The former were typified by the Pacific Coast, Jones, Hall, and twin generator processes and the latter by the Segas and ONIA-GEGI. Both the Segas and the ONIA-GEGI processes were used in the U.K., and the large new development at the Isle of Grain in collaboration with the British Petroleum Co was based on the former method.

Finally, the lecturer dealt with the evaluation of oils for gas-making, pointing out that the carbon-hydrogen ratio and the Ramsbottom Carbon Residue Test were important criteria.

The discussion which followed was opened by S. Ashworth, group production engineer of N. W. Gas Board, and continued in a spirited manner. Prof F. H. Garner of Birmingham University, joint author of the paper, took part and the meeting terminated at 9.30 p.m.

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IP PRESIDENT ELECT

At the December meeting of Council it was unanimously decided to invite the Right Honourable The Lord Geddes to accept the nomination for election as President of the Institute, for the 1956-7 Session, at the Annual General Meeting next April.

Lord Geddes has accepted this nomination.

Lord Geddes, who is very well-known in the oil tanker world, is also Chairman of the Admiralty Fuels and Lubricants Committee and has recently taken his seat in the House of Lords.

Submarine Oil Pipeline—Dekhelia

A fuel oil submarine pipeline laid for the Electricity Authority of Cyprus at their power station at Dekhelia raised a number of particularly interesting problems owing to the ground formations encountered above and below the water line and the rough seas built up by the windy weather.

The work was undertaken under the instructions of the Chief Engineer of the Authority, the consulting engineers were Preece, Cardew & Rider, and construction was carried out by Matthew Hall & Co Ltd.

The average gradient of the ground on which the pipeline was to be built and launched was 1 in 25 and at the water's edge there was a vertical drop over which the pipeline had to be launched, the difference in the pipe levels during launching being 11 feet.

The assembled pipeline laid on the special launching track.

The pipeline was constructed from random lengths of 0·5-inch-walled mild steel tubing, butt welded throughout, with flexible armoured tube hose at the seaward end.

Extending approximately 300 feet from the water's edge, a rock layer made up of two broad shallow reef sections, shelving steeply at the seaward end, had to be blasted to provide a bed along which the pipeline would settle naturally without being suspended over long sections. Preliminary surveys were made underwater by a Matthew Hall team of divers before deciding upon the exact route.

The project divided itself into four parts: preparation of the sea bed; cleaning the ground on shore and constructing a temporary light railway; welding the pipeline on shore; the launching and sinking—much of the work proceeding simultaneously.

Underwater Tasks

Weather played an important part in the project. Each day a strong wind invariably occurred causing rough seas to build up by about noon, and advantage had to be taken of the early morning calms by starting work at 4.30 a.m.

In the earlier stages standard diving equipment was used, but as work proceeded further from the shore, frogman equipment and closed-circuit breathing apparatus were used to allow more freedom of movement and an underwater working period of up to two hours.

Tests with explosives at varying distances from the shore were made to observe whether the power station or fuel oil storage tanks would be affected by shock waves; the reef, however, was a rock conglomerate with a hard crust and soft sandstone interior, well-fissured and porous, in process of erosion, and lying on a bed of sand; shock waves, therefore, tended to be damped rather than transmitted.

The comparative softness of sections of the rock conglomerate, and the underlying sand-bed, made it necessary to cut a V-shaped channel of wide section to prevent it becoming filled before laying the pipeline. The bed of the channel was finally graded to form a uniform transition from the water's edge to the main sea bed at the end of the reef. Rock and debris were cleared so that the pipe would bed into sand and become anchored.

Above-Water Tasks

During the construction of the railway track a welding bay was built alongside. Great importance was attached to achieving a weld quality which would stand up to the mechanical stresses and strains during launching as well as withstanding corrosion; for this reason API—ASME tested welders only were employed by the contractors.

The pipeline was finally welded into two long lengths divided roughly in the centre at a public roadway which was required to be left open for traffic until the day before launching, when the two ends were brought together and welded, and the pipeline hydraulically tested.

A shore guide for the launching operation was fabricated and mounted on a concrete raft close to the water's edge; this lifted the pipe at this point during launching from the flat platform trucks, so that the disengaged trucks were allowed to turn off into a siding. It also dampened out any tremors caused by "snatching" during the towing out to sea of the floating pipeline.

Pre-launching

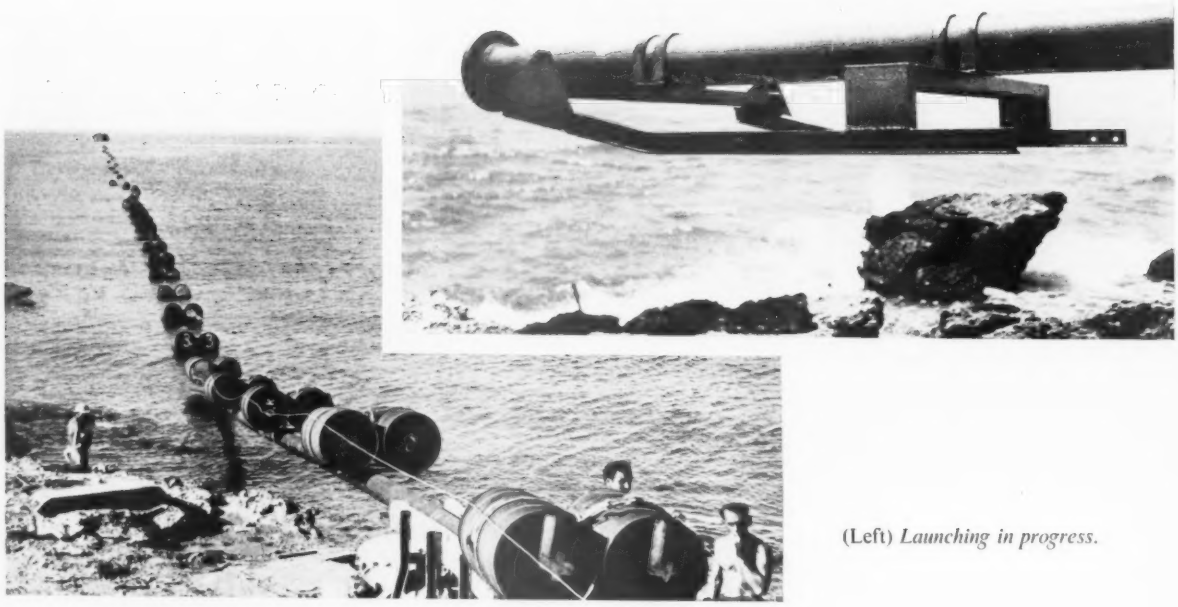
A light anchor and marker buoy were laid to indicate the position of the terminal point for the rigid section of the pipeline.

A power-operated winch was loaded at Larnaca into the hold of a lighter which was towed to Dekhelia and anchored 150 feet beyond the marker buoy. The winch wire was paid out astern over a roller guide and brought ashore ready for fixing to the loading end of the pipeline. Whilst on shore three winches were set up at intervals along the launching line to act as brakes on the pipeline during launching down the shore gradient.

In order to allow the pipeline to override any underwater obstacles for the first two hundred feet of launching, a sledge or "launching nose" was fabricated and bolted to the leading end. The pipeline was too heavy to float, so oil drums were lashed in pairs throughout its length to keep it buoyant whilst towing out. These were attached to hooks welded on top of the pipeline.

A week before launching day, a complete briefing conference was held and specific duties allocated. Next day a

(Right) *The pipeline nose with launching sled in position.*



(Left) *Launching in progress.*

trial launching was carried out; 200 feet of pipeline was launched and recovered, so that everyone would be fully acquainted with their duties. Walkie-talkie sets and a radio communication system were set up between the control point and three contact points.

"L" Day Minus One

The lighter was anchored in position and the winch wire taken ashore.

Two more launches were brought to Dekhelia ready for the launching. The pipeline was jointed and welded at the centre, and hydraulically tested to 300 p.s.i.; the six flexible hose sections were bolted together, tested, and mounted on a slipway, with an empty 44-gallon drum at each flanged joint to give buoyancy.

On shore, a light hand winch was rigged up to trip the oil drums from the pipeline.

Launching

At dawn the flexible hose was launched, one flanged end being bolted to the leading end of the rigid pipeline.

The shore winches hauled the line inshore for a few inches to allow chocks to be removed and then started to pay out. Strain was taken on the winch wire from the lighter to keep the nose of the pipeline on track. The speed maintained was approximately 1 m.p.h., care being taken to prevent the winches working against one another. Halts were made at intervals as the winch wires ashore reached their extremities and they were then re-wound and attached at new points on the pipeline. The inshore end was snubbed to the shore guide to prevent it overshooting. The short section ashore was then lifted and bolted to the existing shore flange on the pipeline from the bulk fuel oil storage tanks.

The drums were released by a trip line operated by the winch ashore. This withdrew wooden wedges which released the drums progressively from the shore, the position being maintained by three launches under radio direction. Finally, a launch tripped the drums from the flexible hose.

The launching took place in the record time of 40 working days from the word "go", an achievement which has enhanced British reputation abroad.

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VAPOUR PHASE CHROMATOGRAPHY

Hydrocarbon Research Group Symposium

Details are now available of the three-day symposium which the Hydrocarbon Research Group of the Institute of Petroleum has arranged for 30 May to 1 June. The meetings will be held in the lecture theatre of the Institution of Electrical Engineers (Savoy Place, London, W.C.2.) in two daily sessions, the first from 9.30 a.m. to 12.30 p.m. and the second from 2 p.m. to 5.30 p.m.

Papers to be presented will number approximately 36 and full details and registration forms can be obtained from H. C. Rampton, British Petroleum Co Ltd, Chertsey Road, Sunbury-on-Thames, Middx. Cost of registration is three guineas and this will entitle members to receive one set of preprints and to attend a buffet supper at 8 p.m. on 29 May at the Hotel Rembrandt.

Books and Films

Safety First

With the toll of road accidents in Britain steadily mounting, any contribution to their reduction is to be welcomed, and the latest efforts of Shell-Mex and BP Ltd in this direction are particularly apt. The first of these is a series of six "film-lets" prepared in co-operation with the Royal Society for the Prevention of Accidents. They concern the "Hog family" and each occupies the screen for only two minutes. The first minute consists of a cartoon accompanied by a ditty spoken by Cyril Fletcher and showing the disastrous results of a member of the family ignoring the rules of the road. In the second minute, Richard Dimbleby strikes a serious note, his opening phrase being "Funny—not if it happened to you", and then shows the result of an actual accident. These films should be shown at every opportunity.

The second and equally important effort is devoted to the dangers of the inexperienced handling of a motor cycle. In this 15-minute film "Learn from the Experts" Geoff Duke and Bill Nicholson explain and demonstrate the way in which a motor cycle should be handled on the road and sum up the golden rules as: "Look ahead and think ahead. When you can do the right thing automatically and have complete mastery of your machine—then, and only then, are you fit to ride on the public highway". Again, a film which deserves the widest showing.

Ulster Grand Prix

The second film mentioned above naturally leads on to "Ulster Grand Prix", the première of which coincided with the London Motor Cycle Show and which illustrated the pick of the world's riders, showing what can be done on a motor cycle. For fifteen minutes one sees the thrills of a really exciting 500 c.c. race with Bill Lomas on a Moto Guzzi establishing a new lap record over the Dundrod Circuit of 94 m.p.h.

All these films are obtainable on loan from the Public Relations Department of Shell-Mex and BP Ltd.

Film of Trans-Antarctic Expedition

A film record of the expedition to the Antarctic has been commissioned by The British Petroleum Company and is to be made, in colour, by World Wide Pictures Ltd.

A cameraman will accompany the advance party and record the setting up of the base on the Weddell Sea for a short film to be shown in the summer of 1956.

The Trans-Antarctic journey will be photographed by George Lowe—who photographed much of the Everest film—and by other members of the expedition. A full-length colour film will then be completed after the party has returned.

Shell "Commercials"

Viewers of commercial television programmes are seeing a series of three-minute films produced for Shell which draw attention to places of beauty and interest in Britain. A commentary by John Betjeman emphasizes special points of interest and gives directions for motorist visitors.

Mechanical Handling

"Mechanical Handling on Show" is the title of a new 16-mm colour film dealing with modern handling methods and appliances demonstrated at recent Mechanical Handling Exhibitions.

The film has a sound commentary which gives information on general operational features of the equipment and on the classes of goods it is designed to handle. It is available free on loan from "Mechanical Handling", Dorset House, Stamford Street, London, S.E.1.

Controlled Heat

The principles and techniques of heat control are expounded in terms which the layman can understand in a new film, *Controlled Heat*, which has been produced recently by the Shell Film Unit.

The law of thermal expansion is traced from its first application in the construction of time-keepers which would be accurate under all climatic conditions to the complex thermostatic controls used today in domestic and industrial processes.

The Automatic Factory

The preface records that this report "attempts to bridge the gap between the theoretical concepts and the actual industrial developments of the automatic factory". It is written principally for the business man "to clarify and expose the sometimes hypothetical and imaginative authors". To achieve this object, the seven authors spent six months research in travel, talk, and reading. Published by Industrial Publishing Co., Pittsburgh 12, Pa., U.S.A., the price is $1.50. Authors are S. A. June, J. D. Bardis, L. H. Lurio, L. S. Polaner, O. Sagedahl, H. A. Sklenar, and B. K. Yerkin.

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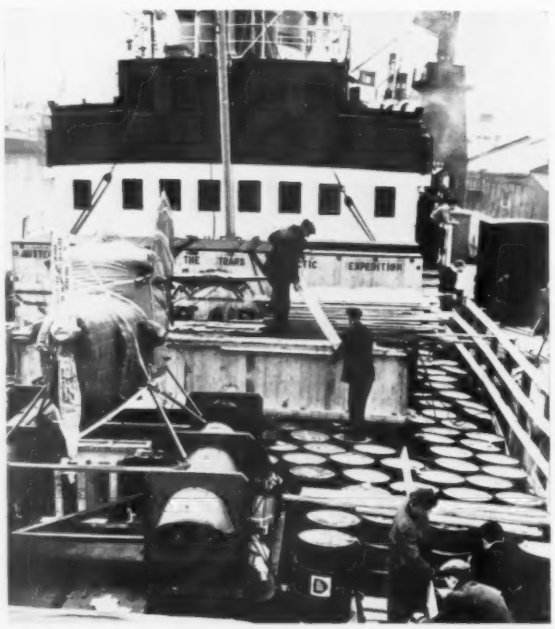


A B P. photo

BP fuels on board the Trans-Antarctic vessel M.V. Theron. *BP has provided, at its own expense, all the petroleum fuels and lubricants, including ships bunkers, for the Trans-Antarctic expedition.*

Some Aspects of Product Quality Assessment*

By J. R. LODWICK†

This paper describes some of the routine work carried out at the Research Station of The British Petroleum Company Limited, in order to ensure that their products will give full satisfaction to the customer, and discusses some of the more interesting unexpected findings. This work not only involves the determination of analytical data, but also requires an evaluation of the suitability of the product for use in the equipment for which it is intended. This equipment may, of course, be situated in any part of the world so that climatic and distribution conditions must be taken into account in any assessment of quality.

Aviation Gasoline

Aviation gasoline is a product which receives a great deal of attention and rightly so, since human life may be involved where fuels are not of adequate quality; any strange or unexplained phenomena are likely to cause consternation, so that a Research Station must be possessed of all the information with which to allay any fears.

Two topics of special interest are lead stability and dichromatism.

Lead Stability

The formation of haze and precipitate in leaded fuels exposed to daylight is well known. A closely allied phenomenon, which was emphasized during the last war owing to the increased use of T.E.L. in aviation fuels, which were often stored for long periods, was the precipitation of lead compounds in dark storage. It was reliably reported that there was much trouble in Germany during the last war, owing to instability in leaded fuels, which was attributed to the large proportions of aromatics in German fuels.

Stabilities of test fuels have been studied by accelerated storage in glass bottles, at 120° F ± 1° F, which were examined for precipitate at daily intervals. Free access of air was permitted but the samples were subjected to the effect of diffused light only during the very short daily inspection periods. The criteria of instability were the recorded times to form "clearly visible" and "heavy" precipitates. As a result of the work carried out it was concluded that:

(*a*) Care should be taken when using aromatic blending agents, particularly those derived from coal tar, to ensure the complete absence of carbon disulphide and a sufficiently low content of thiophenes, as traces of the latter materials promote lead instability.

(*b*) Adequate refining treatment must be given to all components of aviation gasoline.

(*c*) A minimum active inhibitor content of 0·5 lb/4200 I.G. should be maintained in the fuel. The more active inhibitors of the "approved" type, *i.e.*, 2,6-ditertiary, butyl 4-methyl phenol, NN[1] disecondary butyl *p*-phenylene diamine, 2,4-dimethyl 6-tertiary butyl phenol, were found, as expected, to be generally effective in delaying precipitation even when tested in the exceptionally unstable test fuels. Other inhibitors, such as tricresol which is used for motor spirits, have no beneficial effect on lead precipitation.

Dichromatism in 100/130 Grade

It is well known that the specification for 100/130 grade aviation gasoline demands that it be coloured green. It is not at all well known on the other hand that such a gasoline may appear red when viewed in depth, as the following incident shows. An aircraft using 100/130 grade landed by night at a German airfield for refuelling: before commencing loading, the operator shone his torch into the almost empty tanks and saw that the gasoline was a normal green colour. After refuelling, the operator again looked into the tanks and saw to his horror that the gasoline was red in colour. The resulting confusion can be imagined.

This phenomenon known as dichromatism can be explained from a consideration of the visible absorption spectrum of the dye. The spectrum shows high absorption in the violet, blue, and yellow, and low absorption in the green and red, the absorption in the red being less than in the green. Even at small thicknesses a considerable amount of blue and yellow is removed and thus the transmitted energy is essentially green and red. The gasoline, however, appears green owing to the fact that of the energy falling on the eye, which is the most sensitive in the green-yellow region of the spectrum, the green claims the greatest attention. Although with small thicknesses the intensity of the energy transmitted in the green may only be a little less than that transmitted in the red, with bigger thicknesses the difference becomes considerably greater, because the relationship between the ratio of the intensities of the transmitted and incident energies and sample thickness is exponential. Thus, as the thickness of the gasoline layer is increased the transmitted energy becomes richer in red and at a certain thickness the ratio of the red to green components of the transmitted energy becomes great enough to offset the difference between the red and green visibilities. When this is so the gasoline appears red.

Motor Gasolines

Apart from octane number requirements, which are dependent on the compression ratio and design of particular combustion chambers, the factors in motor gasoline quality which give rise to customer comment are:

(*a*) Engine manifold and carburettor cleanliness, which depend on the gum content and potential gum-forming properties of a gasoline;

(*b*) general engine cleanliness, which depends on the refining treatment given to the gasoline and perhaps to some extent on its hydrocarbon composition:

(*c*) vapour locking tendency—dependent on the volatility of the gasoline and on the design of the fuel system.

*Paper read to Institute of Petroleum, Scottish Branch, 9 December 1954.

†Sunbury Research Station, The British Petroleum Company Limited.

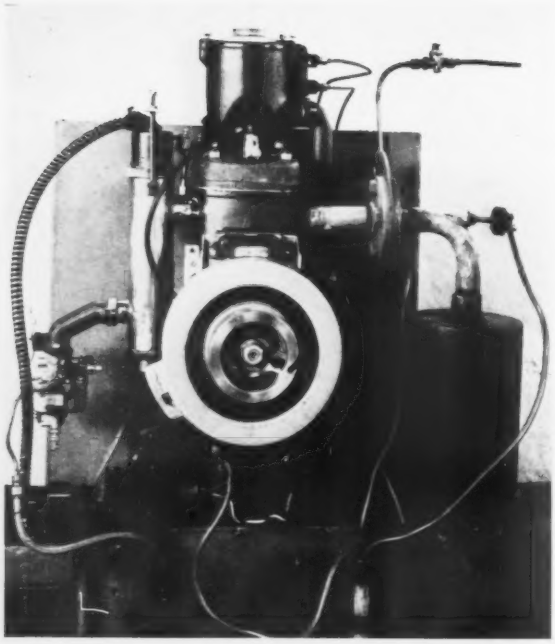


Fig 1. *Lauson engine.*

All of these qualities must be investigated before a new gasoline can be marketed with confidence.

Gum Stability—Engine Manifold and Carburettor Cleanliness

Motor gasolines must not only be satisfactory as prepared in the refinery, but must also be satisfactory after the storage period they undergo before being filled into a customer's tank.

Excessive gum in gasolines results in deposit build-up in the carburettor and inlet manifold of automobile engines and results in customer complaints.

In order to assess, with any measure of certainty, the behaviour of gasolines in motor cars after a period of storage it has been necessary to develop:

(*a*) A method for assessing the engine manifold deposits likely to be formed in an automobile.

(*b*) An accelerated method for ageing gasolines so that they can be artificially aged in a reasonable time for testing as above.

One method of assessing manifold deposit is that developed by the Union Oil Company of California, U.S.A., in which a single-cylinder Lauson engine is used to evaluate the tendency of motor gasoline to form deposits. This was described in a paper presented at the S.A.E. Meeting at Tulsa, U.S.A., in November 1954.

Figs. 1 and 2 show the Lauson engine and its manifold. Five gallons of fuel are used and at the end of the test the amount of acetone soluble gum is estimated by extraction, as shown in Fig. 3. This test has been correlated with manifold gum formed in vehicles on the road, with the results shown in Fig. 4.

Fig. 5 shows how the deposits were extracted from the manifolds of cars.

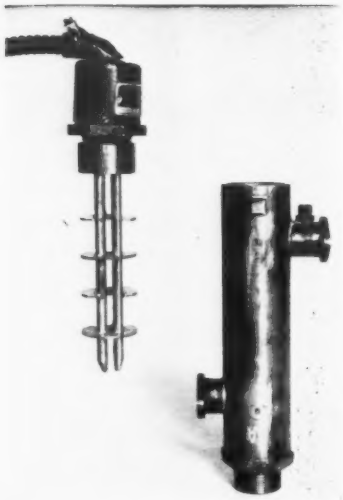


Fig 2. *Manifold of Lauson engine.*

Having thus obtained a method for assessing the manifold gum deposition tendency of gasolines the next step was to develop an accelerated oven storage test.

It is generally accepted that the rate of gum development in cracked gasolines is exponential. Much work has been done on this subject* and the following equation correlates the times required at different temperatures to reach a given gum content: $\log I_1/I_2 = B\,[\,1/T_1 - 1/T_2\,]$

I_1 is the time to reach a given gum content at T_1 °K, I_2 is the time to reach the same gum content at T_2 °K, and B is a constant of average value 5500.

Using this equation the time at 110° F equivalent to storage periods at various temperatures can be calculated.

An oven is available at Sunbury which was designed so that 10- or 20-gallon barrels could be stored at 110° F prior to Lauson or Chevrolet FL.2 test. This enables gasolines to be aged for the equivalent of any desired storage period prior to Lauson test. This oven is represented diagrammatically in Fig. 6.

*Reference *Industr. Engng. Chem.* 1948, **40**, p. 423

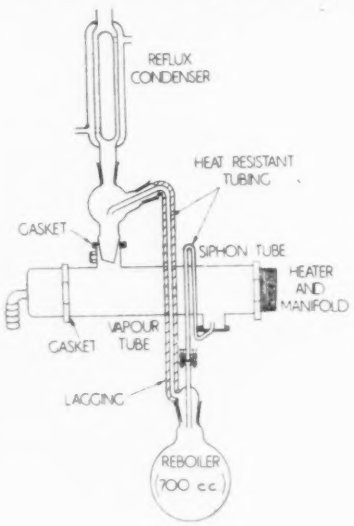


Fig 3. *Lauson engine test assembly for extraction of manifold heater deposits.*

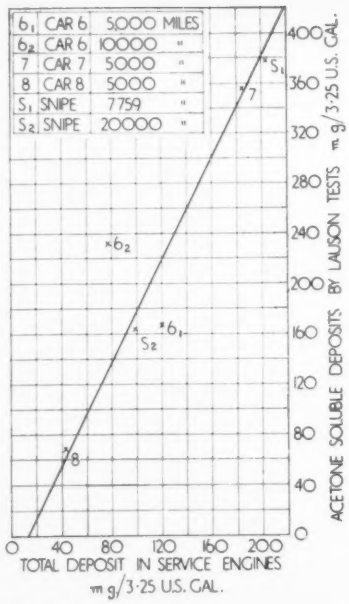

6_1 CAR 6 5000 MILES
6_2 CAR 6 10000 "
7 CAR 7 5000 "
8 CAR 8 5000 "
S_1 SNIPE 7759 "
S_2 SNIPE 20000 "
S_1
7
6_2
6_1
S_2
8
0 40 80 120 160 200
TOTAL DEPOSIT IN SERVICE ENGINES
mg/3·25 U.S. GAL.
0 40 80 120 160 200 240 280 320 360 400
ACETONE SOLUBLE DEPOSITS BY LAUSON TESTS mg/3·25 U.S. GAL.

Fig 4. *Relationship between deposit-forming tendencies of Lauson engine and service engine.*

Engine Cleanliness

Associated with gasoline stability is the problem of engine deposits. This problem is mainly associated with light-load, low-temperature, operating conditions. Gasolines of inadequate stability are known to give varnish and sludge deposits on the pistons under light-duty taxi or delivery service conditions. Normal inspection data cannot be relied upon to forecast the behaviour of a gasoline in this respect. In the United States, the Chevrolet FL.2 test was developed to evaluate this aspect of fuel performance and has been widely used for this purpose. Data, obtained by several laboratories, have been published by the C.R.C. illustrating that the test is reasonably satisfactory in putting fuels in the right relative order insofar as varnish-forming tendency is concerned, provided that the fuel and lubricant combination is the only variable which enters the comparison. BP motor gasolines are examined by this method periodically in order to check the quality of gasolines being marketed. Fig. 7 gives a photograph of the Chevrolet FL.2 test bed at Sunbury.

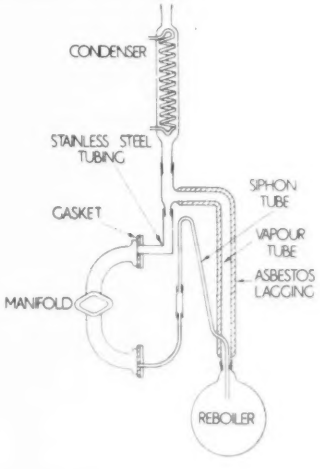


Fig 5. *Humber Hawk manifold assembly for extraction of deposits. The Humber Snipe has central limb blanked off with a gasket.*

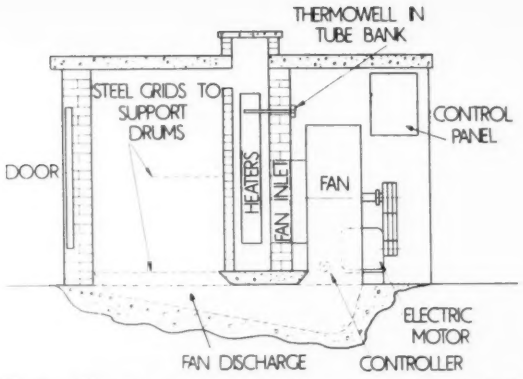
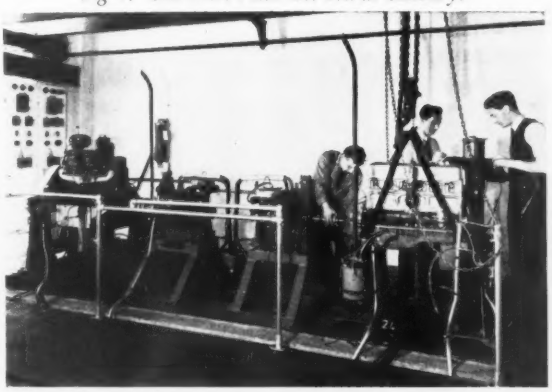


Fig 6. *General arrangement of one compartment of the storage stability oven.*

Fig 7. *Chevrolet FL.2 test bed at Sunbury.*



Vapour Lock

Too high a volatility may, under certain conditions of operation, lead to the formation of vapour in the fuel system; this may result in a reduction in the quantity of liquid fuel being supplied to the carburettor jets. In the worst case so much vapour may be formed that the supply of liquid fuel to the carburettor ceases altogether and the engine stops owing to lack of fuel; this condition is termed "vapour lock". The release of vapour may force fuel into the manifold and prevent idling or easy starting when the engine is hot because of over-rich mixture; this trouble is more usually termed percolation. The factors affecting vapour lock are:

(*a*) The volatility characteristics of the fuel;
(*b*) the temperature and pressure in the fuel system;
(*c*) the ability of the fuel system to handle liquid fuel in the presence of large quantities of vapour.

The volatility characteristics of present-day motor gasolines are balanced to ensure that good starting and warm up, etc. (which require a good volatility) are obtained, together with freedom from vapour lock and similar troubles which may result if the front end volatility is too high.

The operating temperatures in the fuel systems of some cars are however very high, and vapour lock and percolation may occur under adverse conditions even with motor spirit of normal volatility.

Neither the distillation characteristics nor the Reid vapour pressure gives a reliable measure of the tendency of a fuel to

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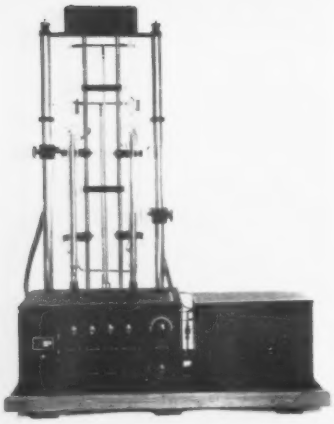


Fig 8. Apparatus used at Sunbury to determine V:L ratios.

cause vapour lock; but this tendency can be correlated with the ratio of the volume of vapour formed to the volume of liquid at the temperatures prevailing in the fuel system as determined by laboratory test. Fig. 8 gives a diagram of the apparatus used at Sunbury for determining V:L ratios.

The vapour locking tendencies of British cars have been studied at Sunbury and limits have been set to the temperatures for specified V:L ratios of fuels according to the climate in which they will be marketed and used.

Tractor Vaporizing Oils

The only serious trouble which has been experienced on tractor vaporizing oils during the last ten years, is that of vaporizer choking on certain types of tractor which employ a labyrinth vaporizer clamped to the exhaust manifold. These manifolds operating at a temperature of *ca* 240° C sometimes become blocked with carbonaceous material after very short running periods, as is shown in Fig. 9.

In order to investigate this problem an agricultural tractor engine was installed on a test bed at Sunbury and various fuels were submitted to an endurance trial at a constant speed of 1100 rev/min until a loss of 10 per cent in power output was obtained. The hours run to give a 10 per cent drop were taken as a measure of fuel quality. Any carbon in the vaporizer channels was scraped out and weighed. As a result

Fig 9. Blocking of manifold when using labyrinth vaporizer.

of such tests BP production was examined and the influence of changes in refining treatment assessed.

The disadvantage of a full-scale engine test is that a comparatively large sample of fuel, *i.e.* 200 gallons, is required, so attempts were made to devise a laboratory test which could be used as a rough check on fuel quality.

Fig. 10 shows the construction of this laboratory apparatus. It consists basically of a length of Pyrex glass tubing wound with "Brightray" tape. The other parts of the apparatus are necessary for providing a constant supply of vaporizing oil to the tube and for condensing the vaporized material leaving the tube. The electrical supply to the winding is controlled by means of a Variac auto-transformer.

A supply of fuel under test is placed in the separating funnel and the stopper inserted. The stem of the funnel is inserted into the constant level well and the tap opened. The height of the funnel is adjusted so that the level of the fuel in the vaporizing tube is about 2 inches above the bottom of the electrical winding. An electrical supply is connected to the tube winding and a current passed. The height of the separating funnel is then adjusted slightly to give a throughput of 240 ml (±5) per hour. Operation is continued until the

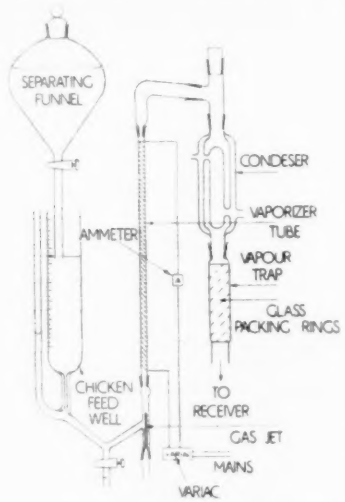


Fig 10. Apparatus employed with straight vaporizer tube.

required amount of fuel (1 or 2 litres) has been passed through the tube. After this has been done the current is switched off, the tube washed with petroleum ether and dried in a current of air. The deposit is then estimated by burning off in a current of oxygen, absorbing the CO_2 so formed in a KOH solution, and estimating it by titration.

Kerosines

Kerosine is widely used in various types of equipment as an auxiliary for home heating during the winter. In spite of the high quality of the product supplied from the refineries, inevitably as with all products, marketing complaints are experienced. For this reason, a variety of types of burner and lamps is available in the research laboratory for investigation of customer complaints. The kerosine is rarely, if ever, to blame, except where it has been contaminated by bad housekeeping on the part of the garage or oil shop proprietor.

Excessive char formation is usually attributed to this type of contamination, but in some cases complaint has been caused by the use of a resin for stiffening the wicks, which

seems to result in a hard char which cannot easily be removed. Sometimes a high smoke-point product will give trouble in lamps merely because the lamp trimmer turns up the flame to its maximum height and expects the lamp to consume only the same amount of fuel as with a smaller flame, which an inferior product would ensure on account of its lower smoke point.

Investigations are also carried out on the performance, flame stability, and general design of kerosine appliances, in order to ascertain whether or not the appliances operate satisfactorily on the kerosines available. They are therefore carried out under conditions of normal usage except where there is particular interest in examining the results likely to occur through misuse.

Sufficient measurements should be made to establish whether or not each appliance fulfils its required purpose; for example, the correct temperature must be reached in chicken brooders and a sufficiently high level of illumination in lamps. Particular attention is always paid to the following points:

(a) *Performance char value.* This is determined, after a performance test on an appliance, in the same manner as the IP Burning Test (*i.e.*, the char is carefully detached and weighed). This test is necessary because the IP char value is not an infallible guide to performance in all types of equipment.

(b) *Drop in flame height.* Excessive flame drop, which affects the illuminating power of a lamp, is usually due to one of the following factors:

(i) The use of kerosine with too high a viscosity;
(ii) excessive moisture in the wicks;
(iii) the fall of the fuel level in the fuel container.

As the distance between the level of the oil and the top of the wick increases, the fuel supply to the wick will decrease and an appreciable drop in flame height may result. This can usually be overcome by modifying the shape of the fuel reservoir so that over a long period of use the fuel level changes by only a small amount. When the performances of different kerosines are compared in the same type of lamp it may *appear* that flame height drop is more marked with high smoke point material than low smoke kerosines. This is owing to the fact that the flame may be turned up more with the high smoke material, so giving a higher rate of consumption and a greater fall in the fuel level. The difference in performance is observed only when the flame is set to the highest possible level or to a fixed illumination level. In tests in which the flame is set to a fixed height (for example, the IP Burning Test) the use of kerosines of different smoke points does not result in a significant difference in flame height drop.

(c) *Formation of a film on lamp chimneys.* The illuminating power of a lamp is reduced by the formation of a deposit on the glass chimney. This is particularly liable to occur with new chimneys containing excess alkali and it is advisable to treat all such chimneys before use by the procedure laid down in the IP Burning Test. IP (10/52T).

(d) *Odour.* The odour sometimes observed during the operation of a kerosine appliance is due mainly to products of incomplete combustion. Tests on a number of kerosine appliances have shown that the odour obtained, both during burning and shortly after extinction is not related to the sulphur content or smoke point of the kerosine. There are, however, indications of possible relationships between performance odour, boiling range, and char value. It is to be expected that a high char formation will lead to poor combustion and may therefore cause a poor odour after a period of operation.

Fig 11. *Different types of fuel filters.*

For the same reason badly maintained equipment often has a strong odour.

(e) *Safety.* Tests on kerosine burning equipment should take into account the safety of the appliance, both indoor and outdoor where necessary, including observations on its mechanical construction and stability.

A sufficient number of temperature measurements are made to ensure that there is no danger of fire. The temperature of the kerosine in the fuel reservoir always rises during operation and it is usually considered that it should remain well below the flash point of the kerosine for safe operation. In the past there have been appliances, particularly chicken brooders, in which the lamp and fuel reservoir were totally enclosed and in which the temperature of the kerosine increased up to and even exceeded its flash point, particularly when the fuel level was low.

The possibility of the formation of carbon monoxide during combustion is always borne in mind, particularly for space heaters likely to function in closed rooms for prolonged periods and chicken brooders in which the combustion gases come into contact with the chickens. However, attempts to measure the concentration of carbon monoxide in combustion gases at Sunbury by the use of potassium palladosulphite tubes have always shown that the concentration is below the

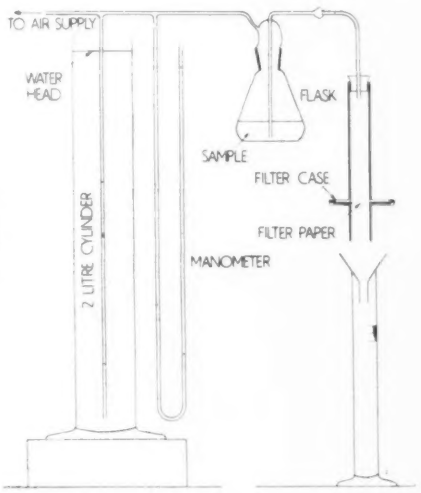


Fig 12. *Filtration apparatus for gas oil and No. 2 fuel oils.*

limit of detection of this sensitive method (0·002 per cent). The limit of physiological effect is usually considered to be about 0·02 per cent, so that all appliances are absolutely safe from this point of view.

Diesel Fuels—Gas Oils

Modern diesel engine builders are very anxious to protect their sensitive injection equipment from abrasive wear and have adopted the use of fuel filters. Three types of fuel filters are in common use and these are illustrated in Fig. 11. The filters may be constructed of paper, cloth, or felt.

The filterability characteristics of gas oils, artificially contaminated with sludge and other materials, were determined on paper, cloth, and felt filters and it was found that the

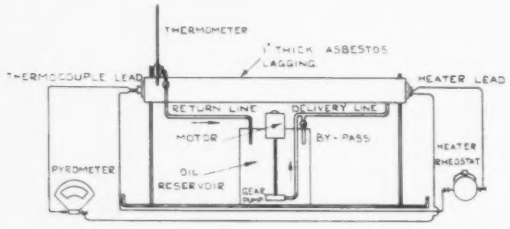


Fig 13. *N.B.T.L. laboratory heater test.*

paper filter was the most efficient, but gave rise to filter blocking most easily. As a result of a programme of work on specially prepared fuels of varying filterability in full-scale engine tests, a laboratory test was evolved, which correlated well with full-scale performance.

A diagrammatic representation of the laboratory filtration test is given in Fig. 12. Basically, the time of flow of 100 ml of gas oil under 20 inches water pressure through a 1-inch circle of No. 1 Whatman filter paper is determined.

It has been found that in cases where complaints of filter blockage arise, this is often owing to contamination of the fuel by placing it in old rusty tanks or by putting it on top of waxy sludge remaining from fuel oil formerly stored therein. It cannot be too strongly emphasized that good housekeeping on the part of the diesel fuel oil user is essential if filter blocking troubles are to be avoided.

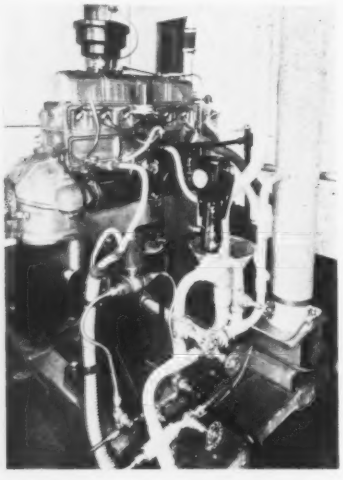


Fig 14. *Chevrolet L.4 engine test.*

Fuel Oils—Stability and Compatibility

The stability and compatibility of fuel oils have received a great deal of attention in recent years. The compatibility of a fuel oil may be defined as its ability to mix in all proportions with fuels of different origins to give stable homogeneous products. A stable fuel may be defined as one in which flocculation does not occur, or in which deposits mainly of an asphaltic or gummy nature are not produced during service or on storage.

Just prior to and during the last war, difficulty was experienced by the U.S. Navy owing to the deposition of carbonaceous or tarry matter in oil preheating equipment installed in their ships. The U.S. "Naval Boiler and Turbine Laboratory" of the U.S. Bureau of Ships, therefore undertook an investigation of the problem with the co-operation of the leading oil companies. It was at first thought that the deposit formation was due to the instability of the fuel oils on heating, but it was soon found that this was not strictly true and that the problem was primarily one of "incompatibility".

As a result of this work a test procedure for the determination of the stability or compatibility of fuel oils, designated the N.B.T.L. Heater Test, was developed by the U.S. naval authorities. The heater test is designed to give an indication of (*a*) the stability and (*b*) the compatibility of a given fuel in blend with a second fuel. The test is illustrated in Fig. 13.

The test consists in circulating the fuel through a heated annulus for a specified time and at a definite temperature and then observing the nature of the deposit on the heated, removable centre tube. For stability purposes the oil is circulated alone through the apparatus and for an assessment of its compatibility characteristics it is circulated in 50/50 volume blend with either of two reference fuels, one of the reference fuels being mainly paraffinic and straight-run, and the other a highly cracked material. For a given fuel to be acceptable for naval use, it must be "compatible" with both types of reference fuel when subjected to the heater test.

Another simpler method for stability and compatibility assessment is used at Sunbury. In this test the fuel or a blend of it with the appropriate reference fuel is placed in a glass bottle fitted with a breathing tube and is stored in an oven for 1 to 8 weeks at 120° F. The sample after storage is shaken and passed through a filter consisting of a disk of 300-mesh copper gauze of 1-inch diameter, suitably placed in a heated cabinet. A record of the time for 100, 200, and 300 millilitres of oil to pass through the filter is made.

When all oil has passed through the filter, the gauze from the filter apparatus is removed and the amount of deposit on the gauze recorded (visual observation). The sample bottle is also examined for any deposited sludge.

This latter test is used as a rough sorting test and has shown some evidence of correlation with the more complicated N.B.T.L. heater test.

Development and Testing of an Automotive Lubricating Oil for the Market

The first step in the development of a new oil is to decide upon the special advantages which will accrue to the motorist who uses it. It is desirable to decide in the laboratory what the most desirable viscosity temperature characteristics of the oil will be, what level of general engine cleanliness is desirable, and what special benefits with respect to anti-wear properties are required. The formulation is worked out on the basis of a highly-refined straight lubricating oil and sufficient amounts of special additives are incorporated to obtain the required characteristics.

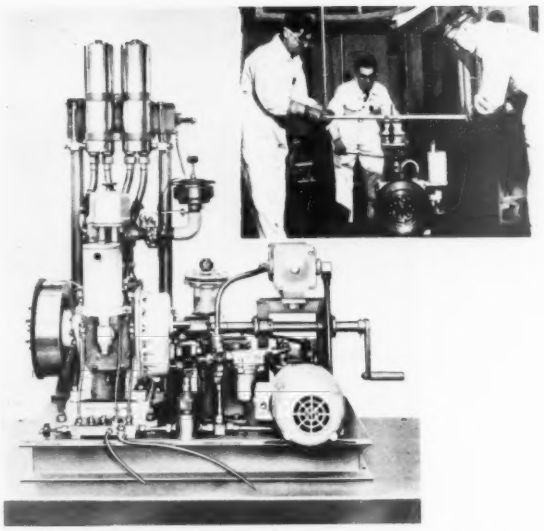


Fig 15. *Sunbury engine high-temperature test.* Inset *shows a radio-active piston ring being fitted to a Sunbury engine.*

Substantial quantities of the finished oil are then prepared and submitted to full-scale engine tests prior to full-scale road tests. Of the many tests used in evaluating a lubricating oil intended for the automotive market the following four are typical:

(a) *Chevrolet L.4 Engine Test* (Fig. 14). This very severe test is carried out to assess the resistance of the oil, under the conditions of high-speed, high-temperature gasoline engine operation to:

(i) oxidation;

(ii) formation of corrosive products and sludge deposition.

The engine is run for about 36 hours and consumes about 105 gallons of fuel. The weight loss of the copper-lead bearings is determined at the end of the test and merit ratings are assessed for piston lacquer, total lacquer, and total engine cleanliness on a scientific basis.

(b) *Cold Sludging Tests.* The cold sludging test is a cycling test carried out at a low jacket temperature and is designed to simulate start and stop running under winter conditions. Under such conditions lubricating oils which have been poorly designed produce aqueous sludges which can cause trouble by blocking filters and oil ways.

(c) *Sunbury Engine High Temperature Test* (Fig. 15). This test of 100 hours duration is designed to evaluate oils with respect to detergency as assessed by piston cleanliness under sustained hard driving conditions. The test is somewhat similar to the Chevrolet L.4 test, but it is run under less arduous conditions for a longer time. (105 hours at 2500 rev/min).

(d) *Wear Rates by the Radio-active Technique.* One of the most desirable properties of a lubricating oil is an ability to reduce engine wear. An excellent way of measuring such wear is by the application of the radio-active tracer technique.

A Sunbury engine piston ring is irradiated in the uranium pile at Harwell for four weeks. This ring is fitted in the top ring groove of the engine as shown in Fig. 16.

During running, radio-active material is worn from this piston ring and is transferred to the lubricating oil. The resulting increase in the radio-activity of the lubricating oil will be directly proportional to the amount of material worn from the piston ring. The rate of increase in the radio-activity of the lubricating oil is, therefore, a measure of the rate of wear of the top piston ring. A Geiger-Mueller counter is used for the measurement of the radio-activity of the oil.

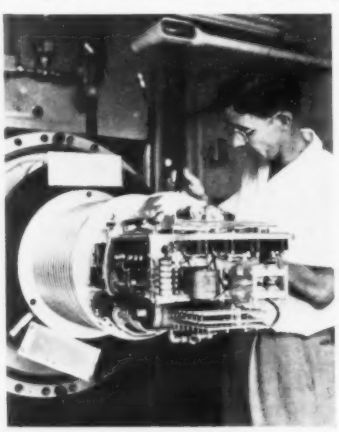
Acknowledgement

The author wishes to thank the Chairman and Directors of The British Petroleum Company Limited for permission to publish this paper.

★ ★ ★

ATOMIC RESEARCH IN THE AMERICAN PETROLEUM INDUSTRY

The Van de Graaff electro-static generator pictured here is an important element in the nuclear research programme of the Socony Mobil Oil Company. Weighing 4½ tons, the generator builds up an electric charge of half a million volts. It supplies neutrons for practical use in improving petroleum products and also gives research workers valuable experience in the handling of radio-active materials.



The Socony Mobil Oil Company's programme of nuclear research has as its aims the investigation of new sources of energy and the improvement of petroleum refinery methods and products. The programme entails the establishment of a nuclear research centre and the construction of a nuclear reactor. The latter task is being undertaken by Socony Mobil Oil Company in conjunction with seven other oil concerns, the reactor being wholly owned by Socony Mobil Oil Company.

CORRESPONDENCE

The Editor, IP REVIEW

SIR,

The Detroit car of the future

IP Review, February, 1954. p. 36.

"Automatic gear change. Press button windows, passenger and driver controlled. Press button radio mast. Press button seat adjustment. Air conditioning. An electric eye dipping lights. Power steering. Power braking. Not long now till the advent of the iron man. Then the car driver can have a rest."

The Sunday Times, 27 September, 1955.

Atticus covering the *New York Times* on Detroit research.

"In 1975 . . . to help the driver manipulate his vehicle, electro-magnetic strips will be laid on the surface of express ways to guide the automatic steering.

"The motorist will drive on to the highway under manual control, set a dashboard instrument to the appropriate speed, pick up the electro-magnetic beam, then sit back and presumably either watch the television, brew tea or shave."

Ellesmere Port, JAS S. PARKER
Cheshire.
1 December 1955

Trade Literature, etc.

Chemical and Engineering Charts

The Horace Priest Chemical Engineering Co Ltd are issuing at monthly intervals a series of technical charts of use in the chemical and engineering trades. The first four of these charts cover log mean temperature difference, temperature conversion (2 charts), and Reynolds number, and the range will cover distillation, heat exchange, absorption, extraction, etc. Each chart is foolscap in size and on heavy paper. An index is to be issued. Application for copies should be sent to the Company at "Beverley", Farthings Hill, Horsham, Sussex.

Vacuum Equipment

Several new leaflets are now available from Edwards High Vacuum Ltd of Manor Royal, Crawley, Sussex, to supplement their catalogue of vacuum equipment. The new leaflets cover vacuum gauges and accessories and equipment for vacuum coating.

"Astip" Centrifuges

The latest leaflet (T.57) issued by Baird and Tatlock (London) Ltd concerns their "Astip" centrifuge, designed to conform to standard tests IP 75 and 145 and ASTM D 975 and 1019.

New U.S. Equipment

Two new products are described in separate brochures recently issued by Podbielniak Inc. of 341 East Ohio Street, Chicago 11, Illinois, U.S.A. The first deals with the "Chromacon" for vapour-phase chromatography and the second with a new design of the "Flo-Kold" low temperature circulating refrigerant unit.

Viscometers are the subject of two bulletins just issued by the Fish-Schurman Corporation of 70 Portman Road, New Rochelle, N.Y., U.S.A. UV-349 deals with the Ubbelohde suspended level instrument and HV-303 with the Hoeppler falling ball viscometer.

Fourth British Plastics Exhibition and Convention

The Fourth British Plastics Exhibition and Convention will be held at Olympia from 10 to 20 July, 1957. For the first time the exhibition will be international in character.

Newman, Hender (Canada) Ltd

Newman, Hender & Co. Ltd., makers of valves, cocks, and fittings for industry have recently formed a Canadian subsidiary company, Newman, Hender (Canada) Ltd., for the distribution, servicing, and stocking of Newman, Hender products in mid-western Canada.

Prefabrication of Deresining Tower

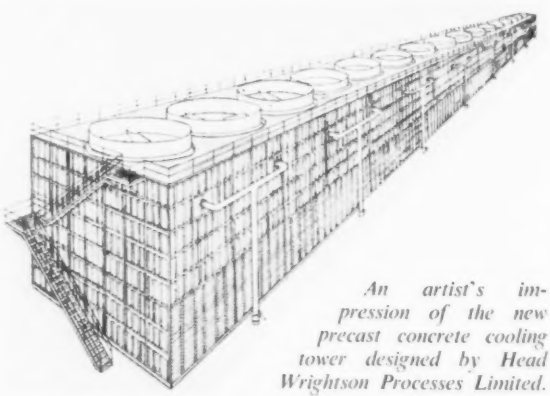
The latest Kellogram issued by The M. W. Kellogg Company describes how a 90-ft 306-ton deresining tower was erected in the middle of an operating refinery. To save time at the refinery the unit was completely shop-fabricated and was shipped in one piece. It was also temporarily reinforced and modified before leaving the shop to cover the moving loads and stresses of lifting.

The innovations necessary to overcome the many problems of the installation are fully described in Kellogram No. 4, 1955 series, copies of which are available from The M. W. Kellogg Company, 225 Broadway, New York 7, N.Y.

New Cooling Tower Installation

An induced draught cooling tower installation which will be the largest of its kind in the U.K. is to be built by Head Wrightson Processes Ltd for a Government Department.

Head Wrightson Processes have developed, in conjunction with John Laing and Sons Ltd, a special type of induced draught cooling tower structure in which all the main units are of factory precast concrete and special consideration has been given to an even distribution of the structural load throughout the ground area.



An artist's impression of the new precast concrete cooling tower designed by Head Wrightson Processes Limited.

Kanigen Chemical Nickel Plate

An illustrated booklet giving details of Kanigen Chemical Nickel plate—a nickel-phosphorus alloy giving a uniform, hard, non-porous coating on components of all shapes—is available from Albright and Wilson Ltd., 49 Park Lane, London, W.1.

Vehicles for Oilfield Use

A range of vehicles for oilfield use has been developed by Anthony Hoists Ltd., 170 Piccadilly, London, W.1., in co-operation with oil company engineers.

The Votator

Recently, members of the technical press and others were invited to visit the works of A. Johnson & Co (London) Ltd to inspect the new Votator laboratory. For many years the Company has been licensed by the Girdler Company of the U.S.A. to manufacture the Votator heat transfer apparatus which has wide applications in many industries. It can perform such functions as heating, cooling, emulsification, mixing, aerating, extruding, etc., and such processes as polymerization, sulphonation, saponification, neutralization, and crystallization can be carried out advantageously. The Company has recently set up a Technical Service Department, which will also carry out fundamental research on heat transfer.

Bubble decks in alloy steel are also manufactured by the firm and they have recently been granted manufacturing rights for the Socony Mobil Oil Company's *Uniflux* trays.

Models in Plant Design

A feature at the Christmas Party and Exhibition held early in December by Matthew Hall & Co Ltd was a demonstration of the use of models in the design and construction

of chemical engineering plants. Scale models ($\frac{1}{2}$ inch to the foot) of the various pieces of plant are placed into a scale model of the building which is to house them, and piping and other details are inserted into appropriate positions. A scale model of an operator is also used to ensure that there is ready access to all operating points and that all valve gear, etc., can be easily reached and handled.

By the use of this method it is claimed that there is approximately a 50 per cent saving in drawing office time and staff.

Various activities of the firm were well illustrated by photographs of plant erected throughout the world.

New Automatic Cheque-Writing System

The Shell Petroleum Company Ltd has recently put into operation an automatic system of producing statements and cheques by means of punched cards at a rate of 300 an hour. This method for the conversion of figures into words, which has not been used before in the U.K., was developed in conjunction with International Business Machines Ltd and involves the use of a special machine which is fed with punched cards giving the supplier's name, address, invoices, and credit notes. The machine then prints a supplier's statement and a cheque showing his name and address and the amount in figures and words.

50 Years of Monel

The fiftieth anniversary of the development of Monel—a wrought nickel-copper alloy with important corrosion-resisting properties—was celebrated by Henry Wiggin and Company Ltd., makers of Monel in the U.K., in November last year.

At a Press conference to mark the event the Company's managing director, I. A. Bailey, spoke of the present shortage of nickel and of the Company's inability to meet all demands for Monel. A constant search was being made, said Mr Bailey, for new and better materials, and new uses were being found for the older ones. Good materials were, however, not so plentiful that one could afford to misuse them. It was the Company's wish that Monel, and the Company's other alloys, should be used only for the jobs for which they were most suitable.

New Fluorocarbon Oils, Waxes, and Greases

A booklet entitled *KEL-F Fluorocarbon Oils, Waxes, and Greases* has been issued by The M. W. Kellogg Company to describe a new series of polymer products based on the polychlorotrifluoroethylene molecule.

These polymer products are especially resistant to chemical attack and other corrosive conditions, temperature extremes, and emulsion and physical breakdown. They are costly to produce and are therefore recommended for critical spots where performance is vital.

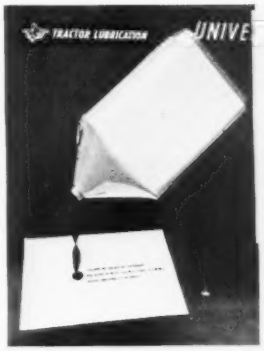
The booklet describing these new products can be obtained from the Chemical Manufacturing Division, The M. W. Kellogg Company, P.O. Box 469, Jersey City 3, New Jersey.

New Control Valves

A new control valve has been designed by Foxboro-Yoxall Ltd. for use with liquids which cannot be allowed to escape even in minute quantities. The new valve is pneumatically operated, with a positive leakproof metallic bellows seal built in below the conventional stuffing box. The normal stuffing box is retained and becomes an emergency safety seal.

The valve is also suitable for use in processes under vacuum where no leakage is permissible because of vacuum loss or process contamination from the atmosphere.

Constant Flow Device



An ingenious display device was used on the Shell-Mex and BP stand at a recent exhibition. The realistic impression of a constant flow of oil being poured from a drum was achieved by a small electric motor rotating a piece of twisted Perspex, coloured to simulate oil, between the lip of the drum and the floor. The display was produced by Acme Showcard & Sign Co Ltd.

Iranian Oil Figures

Production of crude oil in South Iran by Iraanse Aardolie Exploratie en Productie Maatschappij N.V. amounted to 1,433,000 tons in October 1955, giving a total production of 12,699,000 tons for the period 1 January to 31 October.

Refinery throughput by Iraanse Aardolie Raffinage Maatschappij N.V. at Abadan was 576,000 tons in October, contributing to a total of 6,144,000 tons for the period 1 January to 31 October 1955.

Mobil Oil Company Limited

A name which has been part of the U.K. oil industry for 80 years went out of usage in December 1955 when the Vacuum Oil Company Ltd announced a change of name to Mobil Oil Company Ltd.

The reasons for this change are firstly, that the Company's connexion with the "Vacuum" process which it developed has lost its original significance as the process has been supplemented by others; and secondly, that the Company wishes to link its name more closely with the range of petroleum products which are sold in the U.K. and throughout the world under brand names including the word "Mobil". There has been no change in the ownership management or policy of the Company.

Coincident with this change in name the following industrial fuel oils were renamed by the Company: Vacuum Light Fuel Oil (maximum viscosity 250 seconds) has been renamed Mobilfuel Light; Vacuum Heavy Fuel Oil (maximum viscosity 960 seconds) has been renamed Mobilfuel Medium; and Vacuum Extra Heavy Fuel Oil (maximum viscosity 3500 seconds) has been renamed Mobilfuel Heavy.

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CRUDE OIL PRODUCTION

	1955	
	October	*Jan. to Oct.*
Kern Oil Co Ltd:	*Brl.*	
California	107,794	
Trinidad	85,436	
Trinidad Petroleum Development Co Ltd	345,222	
	Tons	
Kuwait Oil Co Ltd	4,722,542	45,162,457
Qatar Petroleum Co Ltd	474,187	4,437,806
Iraq Petroleum Co Ltd	2,070,712	20,036,974
Basrah Petroleum Co Ltd	690,446	5,969,392
Mosul Petroleum Co Ltd	111,080	1,072,447

Notes of the Month

Fertilizers to be Produced at Shell Haven

Two new plants which are to be built in the Thames Estuary will convert refinery gases, or other petroleum hydrocarbons, into ammonia and nitric acid for use in the production of fertilizers.

This is the result of a long-term agreement between the Shell Chemical Co Ltd and Fisons Ltd. The first plant, costing £6½ million, is to be built at Shell Haven and will be completed by 1958. If land is available a complementary plant will be built nearby by Fisons which will use 60,000 tons of the Shell Haven ammonia for production of ammonia-based fertilizers.

The balance of the Shell Haven output will be used by Shell for the manufacture of ammonium-nitrate-limestone fertilizers for agriculture, and anhydrous ammonia and nitric acid for industry.

Diesel Electric Locomotives for British Railways

An order for 20 diesel electric locomotives has been placed with Brush Bagnall Traction Ltd by the British Transport Commission. The order is worth nearly £1½ million.

A total of 2500 diesel electric engines is scheduled as part of the modernization programme for British Railways and this initial order is regarded as a pilot order. Delivery of the first locomotive is expected in the autumn of 1957 and the rest will follow at the rate of one locomotive every three weeks.

The locomotives which have been ordered have a fuel capacity of 500 gallons—sufficient for approximately 500 miles. They are to be used for passenger and freight services and will have a maximum safe speed of 75 miles per hour.

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A Shell photo

Mr Thomas Brookbank, chief engineer at Shell Haven oil refinery, leaving Buckingham Palace with his wife and son after being invested by Her Majesty the Queen with the Order of the British Empire.
The decoration was awarded to Mr Brookbank in the Birthday Honours List in recognition of the part he played in helping to extinguish a fire at the Shell Haven refinery in February last year.

They are design Type AIA-AIA, and consist of a superstructure mounted on two bogies, each having three axles of which the two outer ones are motored and the centre is used only for carrying purposes. There will be a driving cab at each end and provision for connecting gangways for use in multiple working.

Each of the two bogies has six wheels with a wheelbase of 14 feet. The overall length of each locomotive is 57 feet and in working order it weighs 104 tons.

The power unit consists of the Mirrlees vee-form 12-cylinder turbo-charged, four-stroke oil engine developing 1250 h.p. at 850 rev min, coupled to a Brush generator with a continuous output of 828 kW. An auxiliary generator is flange-mounted on the main generator and the output from this is used to drive the air-brake compressor and the vacuum compressors. Engines and electrical equipment of this type have already had considerable service in Ceylon.

In the preliminary tests, to be carried out by British Railways, particular attention will be paid to the performance of the diesel engines, and in this respect ease of maintenance will be most important.

Tractor Fuel Consumption

Recently, the Ford Motor Company Ltd carried out a six-day continuous ploughing test on the Elveden Estates near Thetford. A Fordson Major Diesel tractor with a FR TS 73 12-inch four-furrow mounted plough was used and in the 144 hours an area of 283·7 acres was ploughed. Fuel consumption was 215·2 gal, equivalent to 1·49 gal per hour or 0·76 gal per acre.

L.P.G. Plant for Hamburg Refinery

Some 50,000 tons of butane and propane will be produced by a new gas recovery plant which has recently been commissioned at The British Petroleum Company's Hamburg refinery. The liquid gases will be dispatched in bulk and will be used for domestic and general industrial purposes and for the manufacture of chemicals.

New Oil Search in India

Drilling has begun for the first time in the Hugrijan area of Assam—one of two areas in Upper Assam for which prospecting licences have recently been granted to the Assam Oil Co Ltd.

The site chosen for the first test well is at Naoholia, near the Nahorkatiya area where wells 9 and 10 are being drilled.

Drilling will begin in the other new concession area of Moran early in 1956.

President of Royal Academy Opens Shell Art Exhibition

Shell's 4th Staff Annual Art Exhibition was opened on 10 November, at 31 Great St. Helen's, by Professor A. E. Richardson, President of the Royal Academy.

Professor Richardson toured the Exhibition of 134 pictures and especially recommended 35 of the exhibits.

An award of ten guineas personally offered by F. A. C. Guépin, a managing director of the Royal Dutch/Shell Group, for the best entry from competitors under 30 years of age, was presented by Prof Richardson to Mrs S. T. Hitch, a draughtswoman at Shell Court.

A Shell photo

Shell's new petrol lorry with plastic tank.

Plastic Tank for Swedish Petrol Lorry

Fibre-glass-reinforced plastic has been used for the tank of a 1364-gallon petrol lorry which has recently been brought into service by Shell in Sweden.

The tank weighs about half as much as a similar tank made of steel—an important factor as the Swedish authorities do not permit an axle load of more than 6000 kilos (13,230 lb). This saving in weight means that the tanker can carry approximately 132 Imperial gallons more petrol than the usual steel tank—an additional payload of about 10 per cent.

Lightness is combined with strength in the material used, which consists of a cold-setting polyester resin combined with glass-fibre cloth and chopped glass straw mat. It is said to have practically the same strength as steel but has a specific gravity of 1·7 against 7·8 for steel and 2·4 for aluminium.

The cabin of the new lorry is made of the same plastic.

A road tanker incorporating this material has already been constructed in the United Kingdom and others have been produced in the U.S.A.

1st Anniversary of Iranian Agreement

Figures calculated for the first 11 months of the Iranian Oil Agreement, which came into effect on 29 October 1954, show that in that period Iran received over £26,700,000—in cash payments or oil—from the oil industry in the southern province of Khuzistan. Payments for the Iranian year ending in March 1956 are expected to be in the region of £35,000,000, plus £18,000,000 in foreign exchange brought into the country to meet operating expenses.

These figures appear in a report marking the first anniversary of the Agreement which has been issued by the Operating Companies in Iran.

These two companies, Iraanse Aardolie Exploratie en Productie Maatschappij N.V. and Iraanse Aardolie Raffinage Maatschappij N.V., together employ some 48,800 Iranian staff and workmen and 300 foreign specialists.

Production during the first 11 months covered by the Report amounted to 12,666,000 tons and this was transported by a 1700-mile pipeline network to the loading port of Bandar Mashur and to the Abadan refinery.

Development has been carried out during the year both at the loading port and at the refinery. Bandar Mashur is now able to handle 50 tankers a month—including super-tankers up to 38,000 tons—and when a fourth jetty is added in 1956 it will be capable of handling a total of 90 tankers.

At Abadan exhaustive overhauls have been carried out, including the reconditioning and bringing into commission of the refinery's catalytic cracking unit.

Increased amenities have also been developed during the year. Hospital and clinical services are being extended and the construction of workers' houses is well under way. Responsibility for these supporting services is gradually to be assumed by the National Iranian Oil Co which will then provide the services, on payment, to the operating companies.

IPC Agreement with Syria

Iraq Petroleum Company Limited announced recently that it had reached agreement with the Syrian Government on the revision of payments under its 1931 Convention in respect of the Company's pipeline and terminal operations in Syria.

An agreement reached in Damascus on 26 November will give the Syrian Government a revenue of some £6,500,000 sterling on the expected rate of throughput of approximately 26,000,000 tons during 1956.

The sum of £6,500,000 is made up of payments of 1*s.* 4*d.* per hundred-ton-miles for the distance traversed through

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H.M. Queen Ingrid of Denmark inspecting a model of the Esso refinery, Fawley, on the Dansk Esso stand at the recent British Trade Fair in the Tivoli Gardens, Copenhagen.

Syrian territory, and 1*s.* 1*d.* per ton on the terminal throughput. These payments, amounting to some £6,000,000, are, in fact, equivalent to 50 per cent of the calculated profit on the pipeline and terminal operations in Syria. In addition, there are port dues and security payments amounting to £500,000 per annum.

The Company has also agreed to pay Syria the sum of £8,500,000 in settlement of all outstanding claims between the two parties.

Use of Fuel Oils in Gas Turbines

A new filtration method is now being developed in the U.S.A. which will enable No. 6 fuel oil to be used in gas turbines. The development has been sponsored by The General Electric Company.

The low cost advantages of No. 6 fuel oil have previously been offset by accelerated corrosion in gas turbines which has been traced to contaminants in the oil originating in the crude oil, in sea water during shipment, and in the refining processes.

A filtration process devised by a chemical engineer for General Electric has shown that it is economically feasible to reduce the sodium concentration from 200 ppm to 2 ppm and to achieve substantial reductions in the amounts of calcium, iron, aluminium, lead, and magnesium, as well as in the amounts of sediment and total ash.

Work is now being continued to increase the efficiency of the process and to determine whether it is equally applicable to No. 6 fuel oils of all types.

Aviation Gasoline Plant for Kent Refinery

Some 130,000 tons of aviation gasoline will be produced each year at The British Petroleum Company's Kent oil refinery when new plant comes into operation in 1958.

There is a growing demand for fuels for turbine-engined aircraft and for aviation gasoline of the highest octane rating. The new Kent refinery plant will result in a considerable dollar saving by cutting imports of aviation gasoline from the U.S.A.

Extreme Pressure Gear Oils

A new specification for extreme pressure gear oils which will be used for the provision of gear oils to the Services has been issued by the Chemical Inspectorate of the Ministry of Supply. This specification (C.S.2758) requires performance testing of gear oils before approval.

Copies of the specification can be obtained from the Director of Chemical Inspection, Station Approach Buildings, Kidbrooke, London, S.E.3. Enquiries relating to approval of oils should be addressed to Chemist in Charge, Chemical Inspectorate, 12-14 Tavistock Street, London, W.C.2.

Gear Oil Qualification Panel

An independent panel has been set up to advise the Director of Chemical Inspection on the performance testing of gear lubricants. Chairman of the panel is Dr F. T. Barwell of the Mechanical Engineering Research Laboratory, D.S.I.R.

The panel will meet at two-monthly intervals to review gear tests and to advise on the approval of extreme pressure gear oils. Independent test facilities are being provided at Farnborough by The Inspectorate of Fighting Vehicles, Ministry of Supply, which will also supervise arrangements for tests in other laboratories.

B.E.M. for Young Shell Seaman

An 18-year-old seaman employed by Shell Tankers Ltd has been awarded the B.E.M. for a brave attempt to save the lives of two drowning shipmates.

The seaman is Peter Newland, a member of the crew of M.V. *Asperity*. The incident occurred at Vlaardingen, Holland, when a man lost his footing on the quay and fell into the river which was covered with thick black fuel oil. Another member of the crew dived into the river to rescue the seaman but could not locate him. A lifebuoy was thrown in but the oily conditions made it impossible for him to reach it. Newland then jumped in and succeeded in reaching the lifebuoy with the first seaman. All three men were later picked up, but only Newland survived, the other two dying from the effects of swallowing fuel oil.

The B.E.M. was presented to Newland on behalf of the Minister of Transport and Civil Aviation by A. S. C. Hulton, managing director of Shell Tankers Ltd.

Another award, The Daily Herald Order of Industrial Heroism, was presented to Newland at a ceremony performed by Tom Yates, C.B.E., general secretary of the National Union of Seamen.

ASTM Mass Spectrometry Conference

The Fourth Conference on Mass Spectrometry under the sponsorship of ASTM Committee E-14 will be held at the Netherlands Plaza Hotel in Cincinnati, Ohio, during the week commencing 27 May 1956.

Papers are invited on all aspects of mass spectrometry and those interested are invited to submit abstracts of their papers by 15 February 1956, to the chairman of the Sub-committee

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This special display, which has recently been on show in the windows of Gas Board showrooms, draws attention to the long-standing co-operation between the gas industry and the National Benzole Company.

28,891,000 gallons of crude benzole were extracted by the gas industry in the last financial year—about a quarter of the United Kingdom's total production.

on Programmes and Papers, W. Priestley, Jr., Esso Research & Engineering Co, Box 121, Linden, New Jersey.

Further information may be obtained from A. B. Kent, Secretary, ASTM Committee E-14 on Mass Spectrometry, Sun Oil Company, Marcus Hook, Pennsylvania.

New Alkylbenzene Plant

A new Shell chemical plant which is being built at Shell Haven, Essex, will produce 20,000 tons of alkylbenzene a year.

The plant is due for completion this month at a cost of £1,250,000.

Alkylbenzene is the basis of many of the synthetic detergent powders for which there is a growing demand. Shell Chemical has previously had to import alkylbenzene from Curaçao where alkylates for high-grade aviation fuel were manufactured for Shell during the last war.

Shell's U.K. refineries will supply the majority of the petroleum-based feedstocks required for the new plant.

Synthetic Glycerol Plant for Pernis

Europe's first synthetic glycerol plant is to be built at the Shell refinery at Pernis, Holland. It will cost approximately £2½ million and is expected to be in operation at the end of 1957.

The synthesis of glycerol from propylene—a gas produced in the refining of petroleum—has been carried out by Shell in the U.S.A. for many years. Glycerol is an essential raw material for a wide range of industries from foodstuffs to protective enamels and this new source will provide a reliable supply for European needs.

Another American plant is also planned by the Shell Chemical Corporation. It will be constructed at Norco, Louisiana, near New Orleans.

Abadan's Cat Cracker "On-Stream"

Abadan refinery's 35,000-b.s.d. cat cracker, which has not operated since its trial tests were run in 1951, came into commission on 5 November 1955. By 15 November the cat cracker was effectively "on stream" and products were flowing to tankage.

An extensive overhaul, involving a labour force of 300, was necessary before the ceremony on 5 November when H.R.H. Prince Gholam Reza, brother of H.I.M. the Shah, opened the valve of the plant's air blower.

The cat cracker is using a feedstock of wax distillate and Davison Type 3A fluid cracking catalyst.

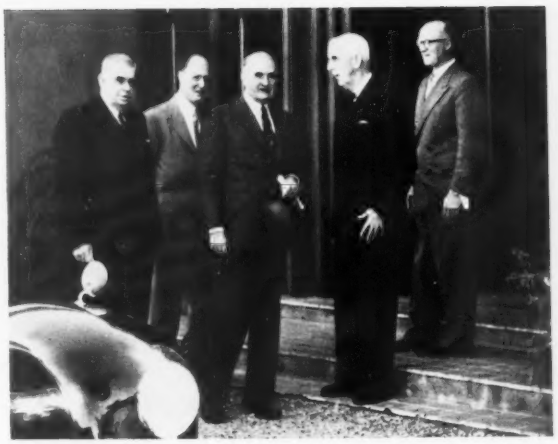
Official Opening of Kwinana Refinery

Kwinana refinery, The British Petroleum Company's new 3,000,000-tons-a-year installation near Fremantle, Western Australia, was officially opened on 25 October 1955 at a ceremony attended by Field Marshal Sir William Slim, Governor-General of Australia. The refinery was brought into operation last February by Australasian Petroleum Refinery Ltd, one of B.P.'s Australian associates.

A. R. G. Hawke, the Premier of Western Australia, Senator W. H. Spooner, Minister of National Development in the Australian Federal Government, and Lord Strathalmond, Chairman of the British Petroleum Company, were present at the ceremony.

In performing the opening ceremony, Sir William Slim said:—

> "The Kwinana project is a wise and efficient combination of official action and private enterprise of which all Australia can be extremely proud."



A BP photo

Arriving for the official opening of Kwinana oil refinery, left to right, D. W. Brisbane, chairman, Australasian Petroleum Refinery Ltd; A. E. Mason, managing director, A.P.R.L.; Field Marshal Sir William Slim, Governor-General of Australia; Lord Strathalmond, chairman of the British Petroleum Co Ltd; D. W. K. Barker, refinery manager, A.P.R.L.

Senator Spooner congratulated The British Petroleum Company on having built the first major refinery in Australia in 1924 and having now built the largest modern refinery in Australia at Kwinana.

Lord Strathalmond said that, as a British company, BP was glad that this major addition to its refineries was situated in so loyal and devoted a quarter of Her Majesty's domains.

"Sure as we are," Lord Strathalmond continued, "that Australia's future will outstrip even the massive record of her past, here at Kwinana is our Company's latest pledge of our determination to promote and partake in her advancing prosperity."

A BP photo

The Governor-General of Australia inspects plant and shakes hands with the Australian labour superintendent after the official opening of Kwinana oil refinery.

Petroleum in Parliament

Oil Pollution

The effects of oil pollution of the sea on sea birds and on beach facilities were discussed recently at Question Time in the House of Commons.

Mr Awbery began by drawing attention to the suffering caused to sea birds by contamination with oil, and asked what progress had been made towards international agreement on the installation of separators. He then went on to refer to a recent collision between two oil burning and oil carrying vessels which had resulted in beaches being covered with oil.

Replying to Mr Awbery, Mr Boyd-Carpenter spoke of the Convention of 1954 whereby it was resolved that Governments would encourage the development of separators and their installation in ships. So far as the United Kingdom was concerned, the Oil in Navigable Waters Act, 1955, had authorized the making of regulations requiring the fitting of separators.

In the case of accidents of the type referred to, however, the fitting of separators had no real bearing on the consequences and it was almost impossible to deal with them by means of legislation.

Technical Colleges—Assistance from Industry

In a recent question in the House, Sir H. Linstead asked the Minister of Education to indicate what assistance he was receiving and expected to receive from the electrical, petroleum, and other technologically progressive industries in this country in connexion with his plans for expanding educational facilities designed to meet present and future shortages of qualified scientists, engineers, technologists, and technicians.

Replying, Mr Vosper said that these industries were co-operating very closely with his Department in the planning of technical education and with individual technical colleges in the planning of courses and by paying for the attendance of students. They also helped many colleges, said Mr Vosper, by gifts of equipment and by encouraging members of their staffs to serve on governing bodies or to undertake part-time teaching.

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PETROLEUM COURSES

Two new series of lectures of interest to industrial chemists and chemical engineers are to be held at the Sir John Cass College early this year.

A course entitled "Chemicals from Petroleum" is to begin on 9 February and will consist of four lectures intended for advanced and postgraduate students wishing to gain a knowledge of the present scope and future trends in the petrochemical industry.

The second course of eight lectures is to cover the principles and practice of distillation and is to begin on 20 January.

Further details and enrolment forms for these courses can be obtained from the Secretary, Sir John Cass College, Jewry Street, Aldgate, E.C.3.

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Forthcoming Meetings

THE INSTITUTE

(*At* 26 *Portland Place, London, W.*1., 5.30 *p.m.—tea* 5 *p.m.*)

Petroleum Fuels for Domestic Heating and Lighting. G. F. J. Murray, A.M.I.C.E., A.M.I.Mech.E., A.F.Inst. Pet., and D. F. Tompkins, B.Sc., A.R.I.C., M.Inst. Pet. **11 January**

A Legal Department in an Oil Company. F. U. J. O'Brien, LL.B. **8 February**

IP FAWLEY BRANCH

(*At Esso* (*Fawley*) *Recreation Club, Holbury*, 7.30 *p.m.*)

Drilling and Production of Crude Oil. R. K. Dickie, B.A., B.I.A., F.Inst.Pet. **13 January**

Annual General Meeting. Film Show. **27 January**

Exploring in North Greenland. Colin Bull, Ph.D., B.Sc. **17 February**

IP LONDON BRANCH

(*At* 26 *Portland Place, London, W.*1., 6 *p.m.—tea* 5.30 *p.m.*)

Dinner Debate—This House Regrets the Discovery of Petroleum. (At Chatham Rooms, Victoria Station.) **19 January**

Petroleum Refining in the United Kingdom. W. Kohring. **29 February**

IP NORTHERN BRANCH

(*At Engineer's Club, Albert Square, Manchester* 2, 6.30 *p.m.*)

Symposium on the Lubrication of Transport Fleets. Chairman: A. T. Wilford, B.Sc., F.R.I.C., M.I.Mech.E. **17 January**

Annual General Meeting. Speaker: Wing Commander Bader, D.S.O., D.F.C. **21 February**

IP SCOTTISH BRANCH

(*At N.B. Station Hotel, Edinburgh*, 7 *p.m.*)

Annual General Meeting
Talk by R. Keddie (at 7.30 p.m.) **26 January**

The Design and Manufacture of Welded Pressure Vessels. T. B. Webb. (At Inst. of E. Engineers & Shipbuilders, 39 Elmbank Crescent, Glasgow, 7.45 p.m.) **9 February**

IP SOUTH-EASTERN BRANCH

(*At King's Head Hotel, Rochester*, 7.45 *p.m.*)

Atomic Power. I. Wells, B.Sc., M.I.Chem.E. **7 February**

IP SOUTH-WALES BRANCH

(*At Training Centre, National Oil Refineries, Llandarcy*, 5.30 *p.m.*)

Annual General Meeting. Film Show. **2 February**

IP STANLOW BRANCH

(*At Grosvenor Hotel, Chester*, 7.30 *p.m.*)

Annual General Meeting (At 7 p.m.)
Presidential Address **18 January**

Combustion of Liquid Fuels. G. J. Gollin, M.A., M.Inst. F., M.I.Mech.E. (Joint meeting with Institute of Fuel) **15 February**

ECONOMICS AND OPERATIONS GROUP

(*At* 26 *Portland Place, London, W.*1., 5.30 *p.m.—tea* 5 *p.m.*)

The Price of Oil. D. H. Barran. **1 February**

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PATENT

The Proprietor of British Patent No. 650286, for "Improvements in Methods and Means for Guiding, Floating, and Cementing Well Casing in Bored Holes," desires to grant manufacturing licences or to make other arrangements on reasonable terms, for the purpose of working the invention in this country. For further particulars apply in first instance to Mathys and Squire, 52 Chancery Lane, London, W.C.2.

THE POLYTECHNIC

309 Regent Street, W.1

Four lectures on "APPLICATIONS OF LUBRICATION" will be given on Mondays at 7 p.m. commencing 6 February 1956, by Dr H. E. Priston and Mr B. R. Pyke. Fee for the course: £1. Application forms and further details may be obtained from the Head of the Department of Chemistry and Biology.

J. C. Jones
Director of Education

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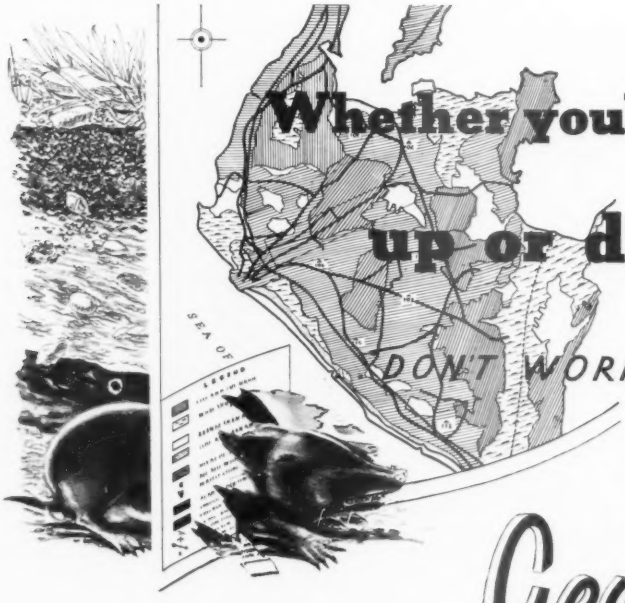

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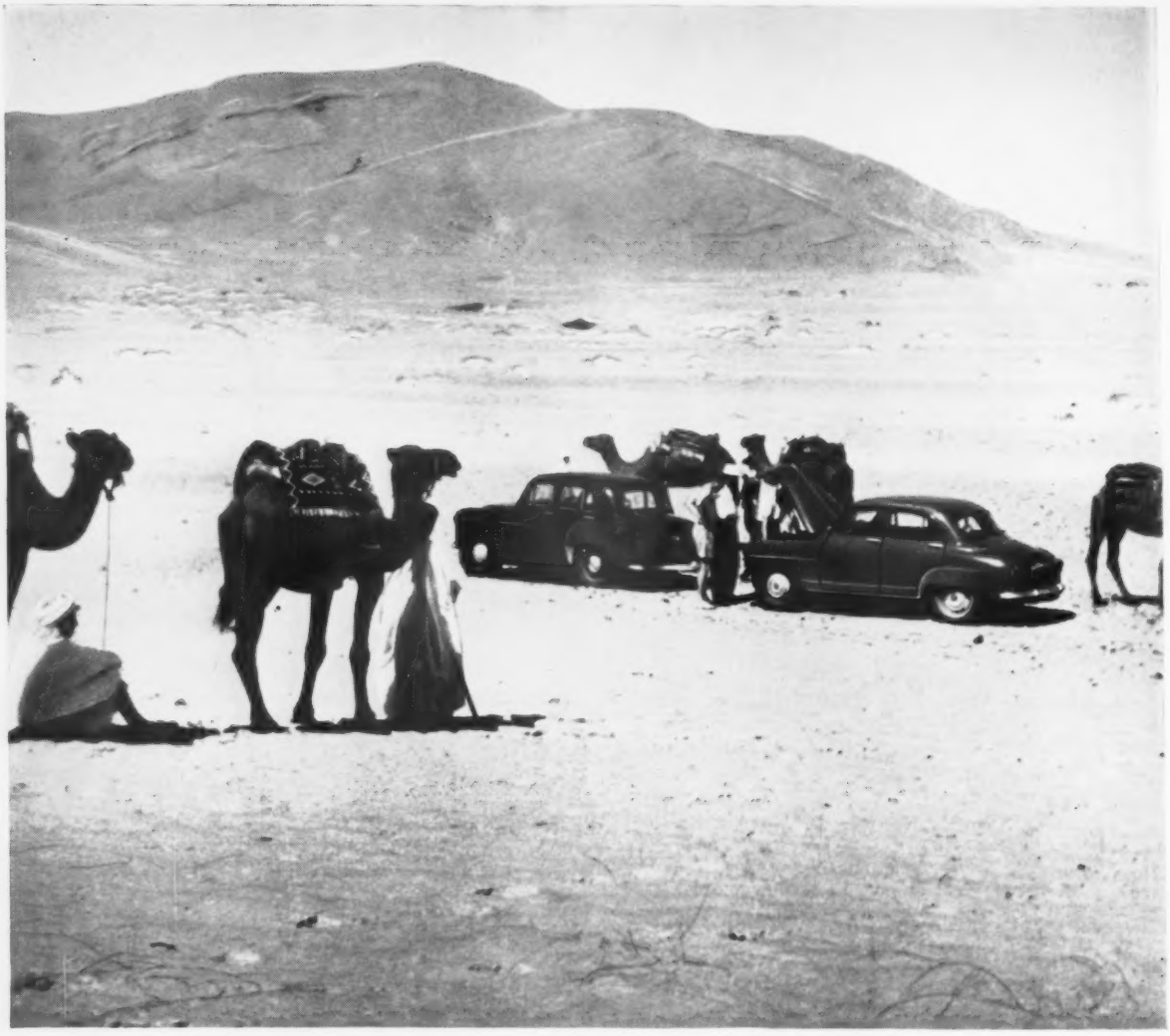

BP TESTS IN THE SAHARA

DRIVING an average of 1,000 miles a day for 16 days, a team of technologists from the BP Sunbury Research Station has been testing specially blended fuels to assess performance in hot climates. On desert tracks in the Sahara. On steep climbs in the Atlas Mountains. At high speeds. In gruelling temperatures up to 110 degrees in the shade.

Continuous research into every stage of the production, refining and use of oil is part of the unequalled service of which the BP Shield is the symbol: a service to millions of motorists in Britain, in Western Europe and in many other parts of the world.

The BP Shield is the symbol of the world-wide organisation of

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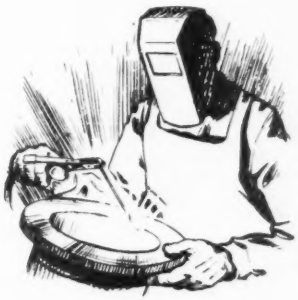

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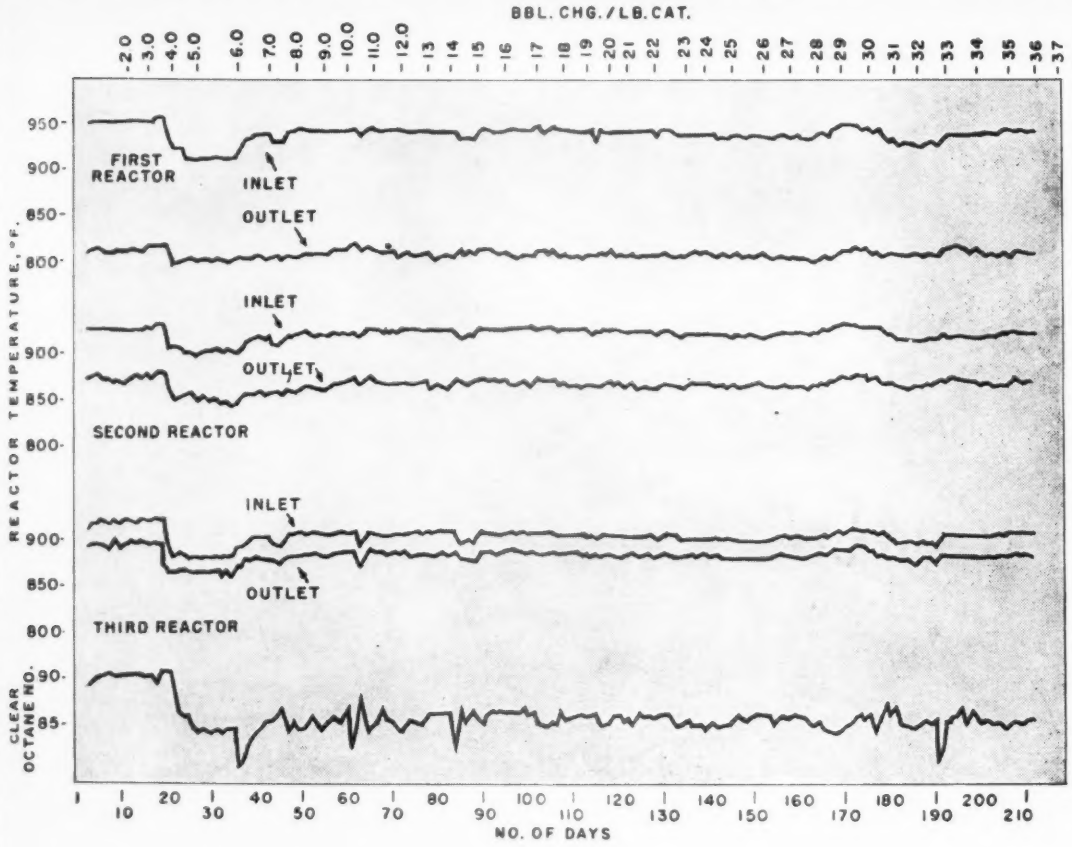

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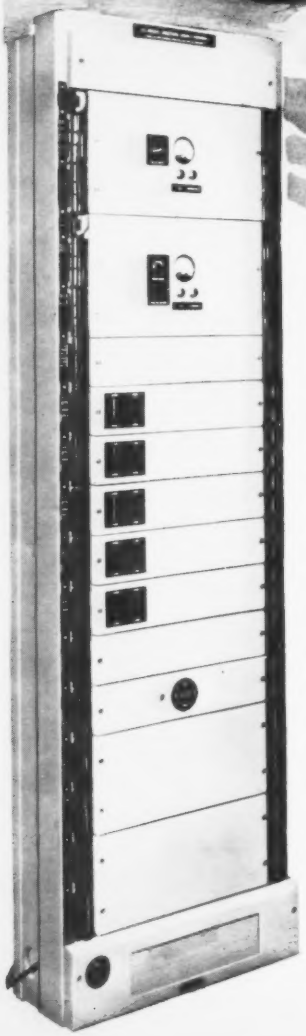

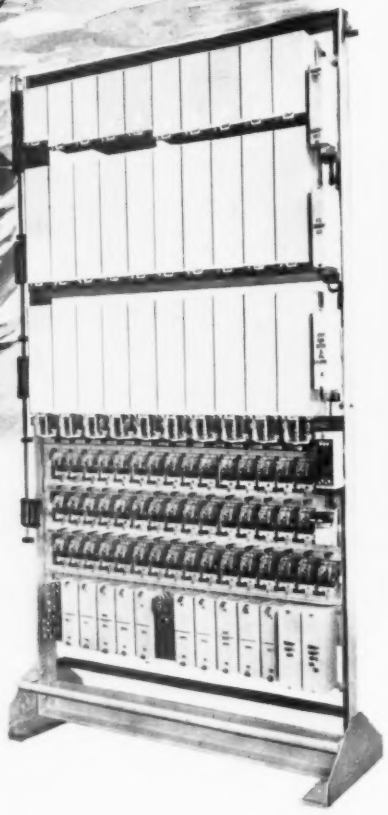

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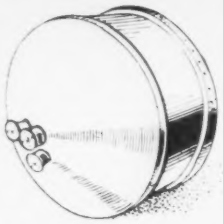

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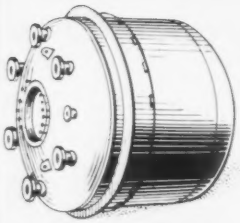

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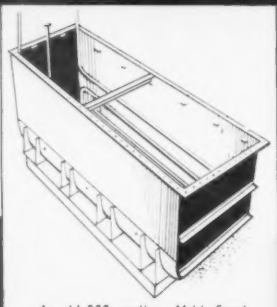

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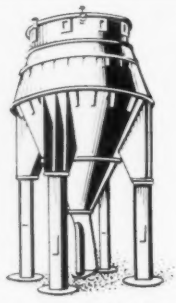

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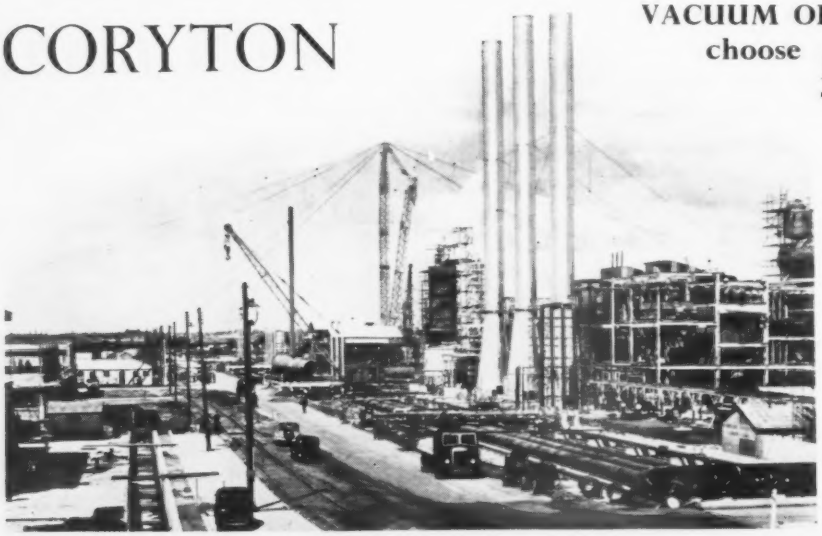

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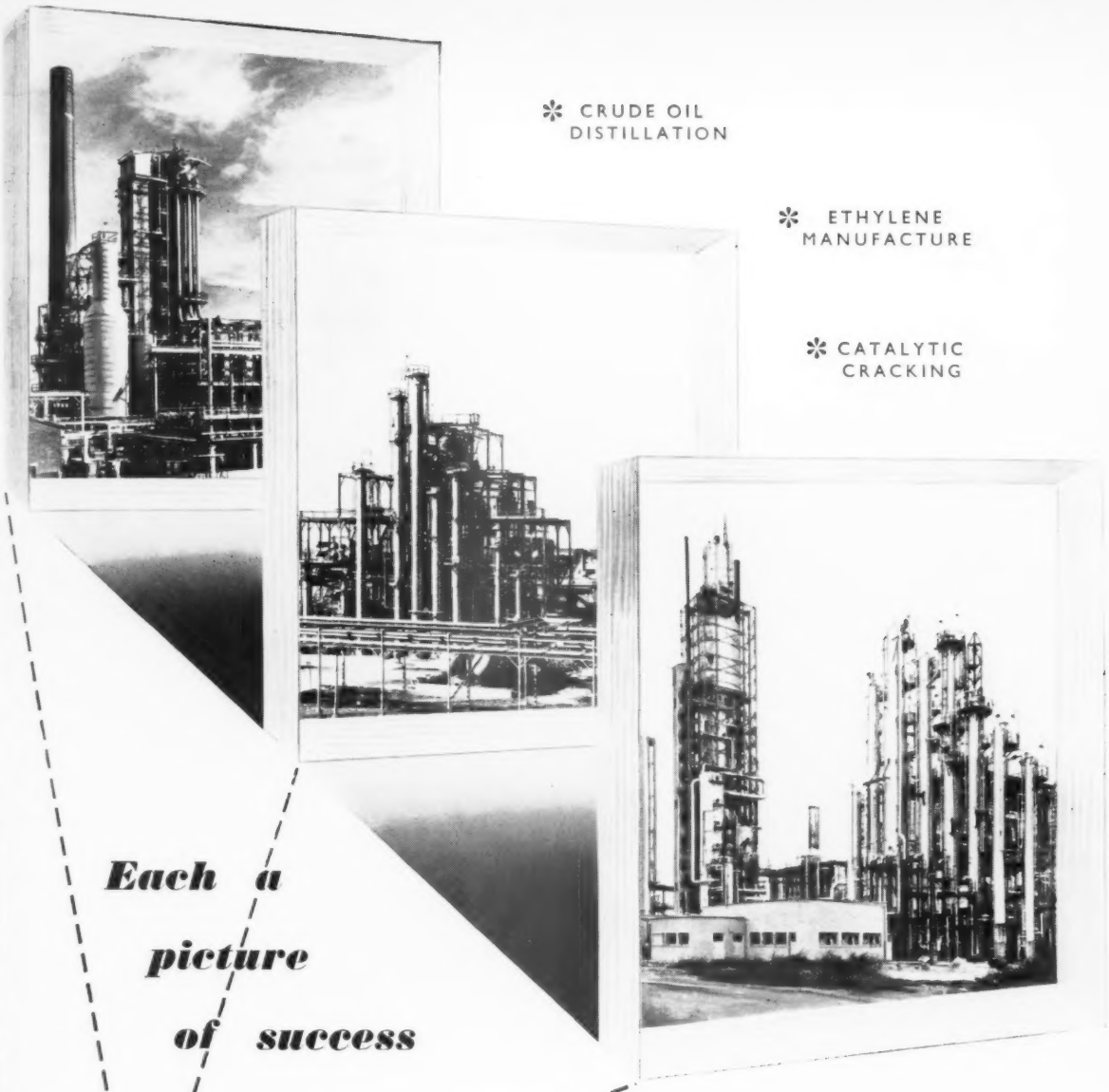

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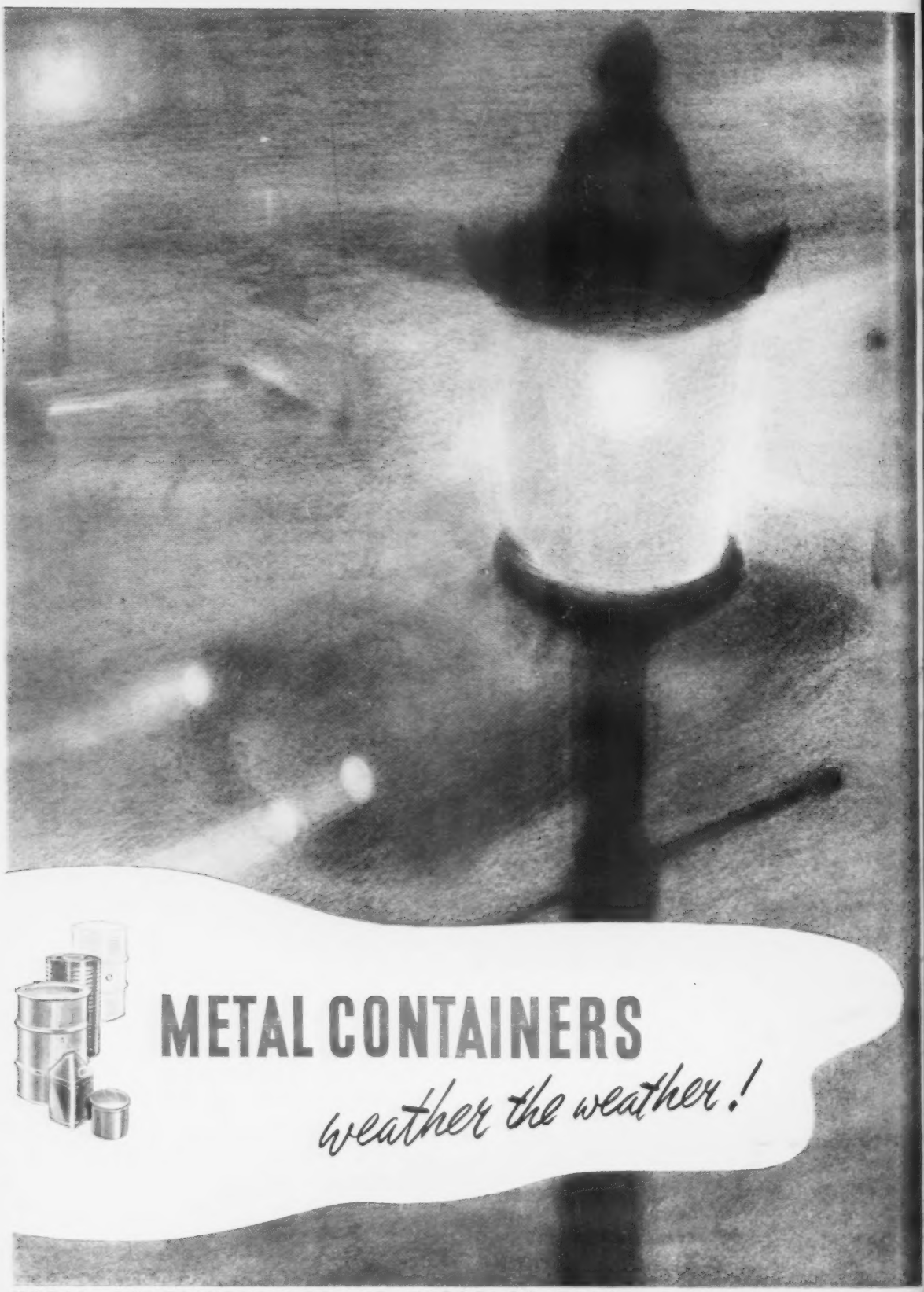

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